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AN EVALUATION OF THE EFFECTIVENESS OF SELECTED METHODS FOR REDUCING SEASONAL FLUCTUATIONS IN INDUSTRIAL MILK SUPPLY

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled AN EVALUATION OF THE EFFECTIVENESS OF SELECTED METHODS FOR REDUCING SEASONAL FLUCTUATIONS IN INDUSTRIAL MILK SUPPLY.

submitted by LORRAINE COLLEEN BASSETT

in partial fulfilment of the requirements for the degree of Master of SCIENCE

ABSTRACT

Seasonal fluctuations in milk production have been a longstanding problem in both the Canadian and American milk industry. Typically, the problem has been one of high milk production in the spring and early summer months with a marked drop in milk production in the fall and winter. In the province of Alberta, nearly twice as much industrial milk was produced in May 1976 as in November.

In Canada, seasonal fluctuations in milk production are predominant in the industrial milk sector. Various programs have been suggested to shift industrial milk production patterns. This thesis attempts to evaluate the effectiveness of two selected methods for reducing seasonal fluctuations in industrial milk supply.

The first objective of this thesis was to evaluate the effectiveness of a seasonal subsidy program in inducing industrial dairy producers to increase their level of winter sales. Information was ascertained on Alberta industrial producers' costs and returns. Based on the information collected, projections of producer returns under various seasonal subsidy rates and their attendant conditions were derived. Each subsidy program proposed in the thesis was assessed on it's ability to increase producer returns. Of the subsidy programs proposed, the winter subsidy program, subsidizing all winter sales at a rate of \$ 5.32/cwt, was judged to be the most effective of the proposed methods of subsidization. The success of the program, however, was found to be dependant on 1) the Canadian Dairy Commission's ability to increase it's subsidy budget allowance and

2) on whether producers' discounted future returns would exceed the cost of making the initail production adjustments.

The second objective of the thesis was to evaluate the feasibility of implementing a seasonal pricing plan for milk - a graded premium and deduction approach to seasonality formulated by Sargent Russell. An analysis of Alberta producers' industrial milk shipment patterns indicated that the introduction of a seasonal pricing plan for milk may hinder the growth of small dairy enterprises. The evaluation of the plan also reveals two major structural problems with the plan's design and suggests means to resolve these problems.

ACKNOWLEDGEMENT

I would like to take this opportunity to thank those individuals and organizations whose cooperation made this study possible. I am especially grateful for the guidance and support provided by Dr. M. Lerohl, my thesis supervisor. Special thanks are also extended to the Production Economics Branch of Alberta Department of Agriculture, the Alberta Dairy Control Board and the processing firms for their assistance in providing information for this study.

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CHAPTER I

INTRODUCTION

The seasonal variation of milk production, particularly milk used for industrial purposes, has been a topic of concern and debate for many years. In Alberta, nearly twice as much industrial milk was produced in May 1976 as in November. Figure 1.1 illustrates the seasonal fluctuations of industrial milk production for the past four years.[1]

Seasonality[2] is a problem in other provinces as well. Federal statistics indicate that Canadian industrial milk production in June 1976 exceeded November by 2.19 times.[3] Generally, the quantities of industrial milk supplied are highest in late spring and early summer and lowest in winter.

Peaks in milk production can be attributed to the economics of producing summer and winter milk.[4] Statistics collected by Alberta Agriculture for fluid milk producers in 1976 indicated that the cost of producing summer and winter milk was $11.59/cwt and $12.92/cwt, respectively.[5] As the price of milk is relatively constant over the

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[1]Statistics Canada, "Table 1.0. Milk Production and Utilization, Canada, by Province, by Month," Dairy Statistics, Catalogue 23-201 (Ottawa: The Minister of Industry, Trade and Commerce, June 1977), p. 10.

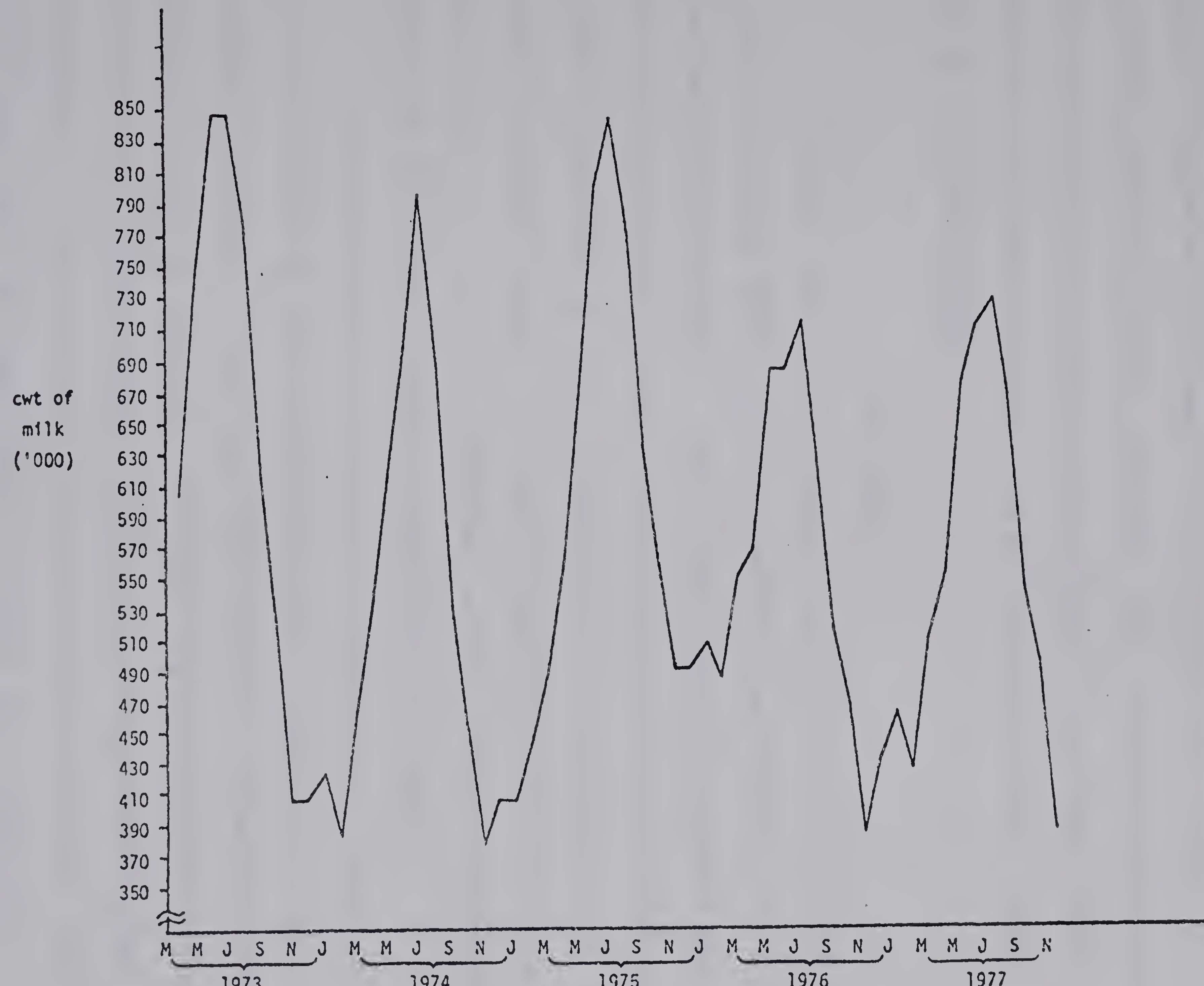
[2]Seasonality refers to seasonal milk production.

[3]Statistics Canada, p. 12.

[4]Henceforth, summer and winter will refer to the months April through September and October through March, respectively.

[5]Rudy Susko, Winter-Summer Cost Variation in Alberta Production, Department Circular (Edmonton: Alberta Agriculture, Production Economics Branch, January 11, 1978).

Figure 1.1--Industrial Milk Production, Alberta, 1973-1977.



Source: Abstracted from information supplied by the Canadian Dairy Commission.

year, the winter profit margin is $1.33 less than the summer profit margin. This is likely to encourage greater summer production. Managerial preference for summer milking has also been suggested as a possible explanation for this phenomenon. This preference may be partly due to the distaste for winter milking in view of the climate and the opportunity provided for producers to utilize their children's labour during the summer holidays.

The Problem

Presently, there are two groups concerned with the seasonality issue--the Canadian Dairy Commission (hereafter referred to as the C.D.C.) and the Canadian processors. Both of these groups' main concern lies with shifting some of the industrial milk production in the spring and summer to the winter so that the supply of milk is distributed more evenly throughout the year. It would be economically advantageous to both groups if this shift in production could be effected as both incur costs that are directly a result of fluctuating milk supply.[1]

Processors' costs associated with seasonality are largely due to inefficiencies in the processing operations. Generally, a plant's processing capacity is relatively fixed; therefore, fluctuations in milk deliveries result in the plant's facilities either being underutilized or overloaded. In peak periods, processors are often faced with two alternatives. Either they must sell their milk to other plants since they cannot handle the large volume of incoming milk or they must

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[1] Dave Wilkins, "Toward a Better Balance," Country Guide, Vol. 97 No. 2 (February, 1978), p. 14.

process the milk into dairy products requiring less labour and equipment time. Conversely, many plants are often forced to shut down in the winter for lack of adequate supplies of industrial milk. Plants that continue to operate in the winter however, often do not utilize their equipment to their full capacity. Consequently, the plants would not earn the returns their operations are capable of earning. For example, the trucks used to haul milk from the farms to the processing plants are often not filled to capacity in the winter.

Seasonality also poses problems regarding the co-ordination of labour. Maintaining idle employees in winter periods is costly; therefore, management is forced to hire unskilled labour as it is required. Usually these jobs are filled by students seeking summer employment. Skilled labour, however, is not always available precisely when needed. Consequently, plants are forced to hire skilled labourers full time. This can be costly as skilled employees are often occupied with unskilled tasks such as painting and other maintenance jobs during the winter months.

Generally speaking, the demand for dairy products does not fluctuate to the same extent as the supply of industrial milk. As a result, dairy products must be stored and released as required. The cost of storing skim milk powder (S.M.P.) and butter is largely paid by the C.D.C. Through an offer-to-purchase program, the C.D.C. buys excess Plan A[1] butter and S.M.P. and stores these products until they can be sold on the domestic or international market. During the 1976-1977

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[1] The government has two plans under which they purchase butter from the processors. Under Plan A, the C.D.C. purchases graded butter and stores it until a market can be found.

dairy year, the storage costs for S.M.P. and butter were $0.0192/lb. and $0.0348/lb., respectively.[1] The C.D.C. also incurs the cost of shipping butter between storage points, e.g., Edmonton to Vancouver, and the cost of interim financing. Under Plan B[2] butter storage, the Commission purchases butter from processors with the intention of selling it back to the processors before a predetermined date. This effectively gives the processors free financing as well as relieves them of the storage costs. The processors, however, must pay the cost of transporting the products from the processing plant to a designated storage area and ensure that the butter is properly packaged for storing.

Seasonality and its attendant problems may remain unless the dairy producers are given some incentive to alter their present pattern of milk production. Several programs have been introduced in the United States to provide such an incentive. These programs have generally followed one of two approaches. Either producers have been provided with some type of monetary incentive, or milk quota restrictions have been imposed during particular periods, forcing producers to adjust their production pattern. Those programs providing monetary incentives, however, have had limited success. Generally, the monetary incentives have not been large enough to induce producers to shift

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[1] Canadian Dairy Commission, Personal Communication, February 1978.

[2] Under Plan B, the C.D.C. will purchase butter from the processors; however, the processors have a moral obligation to buy the butter back before a designated date. The price of the butter sold to the Commission is less than that sold under Plan A. Under this type of plan, the processors are able to keep their inventory supplies up without paying the associated storage costs.

their production pattern. It appears that the value of the monetary incentives have been arbitrarily determined rather than being based on seasonal production cost differences.

As an incentive to shift industrial milk production patterns, the Canadian Food Prices Review Board (F.P.R.B.)[1] recommended in 1974 that a portion of the direct subsidy payment[2] made to industrial producers by the C.D.C. be withheld during the summer months. The amount withheld would be redistributed during the winter months when production was low. This would effectively introduce a summer and winter subsidy rate and eliminate the use of a constant annual subsidy rate. The F.P.R.B. estimated that a five cent deduction during the summer period would allow for an additional \$0.50 to \$0.60/cwt of milk during the winter period. They felt that such a sum would be sufficient incentive for dairy producers to adjust their production pattern.

Inspection of the statistics collected by Alberta Agriculture for fluid milk producers in 1976[3] indicated that the cost of producing winter milk was \$1.33/cwt greater than that of summer milk. If the spread in winter and summer costs for industrial producers is as great as that for fluid producers, a \$0.50 to \$0.60 winter premium payment

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[1]David L. MacFarland and Lewis A. Fischer, Canadian Dairy Industry: Short Term Perspectives (Ottawa: Food Prices Review Board, March 1974).

[2]In order that dairy producers receive a "fair return" on their investment, the federal government annually sets a target support price for industrial milk. The target support price is based on a hundredweight basis. To ensure that this target price is met, producers receive a direct subsidy payment for each hundredweight of milk shipped within their eligible Market Share Quota.

[3]Rudy Susko.

would be ineffective. Information concerning industrial producers' seasonal costs of production must first be ascertained before any recommendation can be made concerning effective summer and winter subsidy rates.

Study Objectives

The first objective of the thesis was to determine whether seasonal subsidy rates would be an effective policy tool to induce industrial dairy producers to increase the level of their winter milk sales. This evaluation is based on the seasonal subsidy rates proposed in the thesis. The differential in Alberta industrial producers' winter and summer costs of production provide the basis for deriving the proposed seasonal subsidy rates.

The second objective of the thesis was to evaluate the feasibility of implementing a seasonal pricing plan[1] for milk as formulated by Russell. In comparison to a seasonal subsidy program, a seasonal pricing plan is more rigid in its approach to seasonality as it monitors the level of milk sales more stringently. Rather than monitoring the level of milk sales between seasons as with a seasonal subsidy program, milk sales are monitored on a monthly basis. Consequently, this plan attempts to reduce seasonality by encouraging a uniform sales pattern throughout the year rather than by equalizing winter and summer sales.

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[1]Sargent Russell, "The Seasonal Pricing Plan for Milk," Journal of Farm Economics, Volume 49, Part 1 (1967), pp. 643-655.

Scope

The thrust of this thesis has been to evaluate two methods dealing with seasonality. It has not been assumed however that seasonal milk production should in fact be reduced. Nowhere in the literature was a cost benefit analysis undertaken to indicate that seasonal milk production was in fact inefficient. It is hoped that the information provided in this thesis concerning industrial producers' seasonal costs of production and the effectiveness of the proposed seasonal subsidy rates will provide the basis for further study into the level and incidence of the benefits and costs of various approaches to seasonality. This would involve a detailed study of the costs and benefits incurred by producers, processors, consumers and the C.D.C. as a result of a seasonality program. This is necessary as it is possible that the costs involved in inducing producers to reduce milk fluctuations exceed the benefits gained by other parties.

That part of the thesis pertaining to the derivation of summer and winter subsidy rates was undertaken as a pilot study. The projected implications of the derived winter and summer subsidy rates should not be construed to apply to the entire industrial shipper population, but only to those producers sampled. A larger sample is required before generalizations can be made regarding the effect of seasonal subsidy rates on producers' production patterns and returns.

In the evaluation of the seasonal pricing plan, questions may be raised pertaining to those variables responsible for fluctuations in milk supply. Most certainly, recognition of these variables would be an asset in designing an effective seasonality program. However, the plan as designed by Russell is not cognizant of the causes, but only

the results. Since the objective of the thesis was to identify the problems and evaluate the feasibility of the plan's implementation, the causes of seasonal milk fluctuations were not identified.

Study Outline

The study proceeds with a discussion of the various sectors of the dairy industry. Following this, Chapter Three reviews some of the approaches used in other regions to counteract seasonal milk fluctuations. In Chapter Four, the methodology used throughout the study is outlined. The results of the dairy cost questionnaires and the effects of a summer and winter subsidy payment on production are discussed in Chapter Five. An evaluation of the seasonal pricing plan for milk is presented in Chapter Six. In conclusion, Chapter Seven contains a discussion of the results, and makes recommendations for further research.

CHAPTER II

A REVIEW OF THE DAIRY INDUSTRY

Milk utilization can be separated into three categories: 1) fluid milk--milk sold in a fresh and fluid form, 2) industrial milk--milk used to make butter, cheese, S.M.P. and other related dairy products, and 3) home use milk--milk used by the farm family for consumption and livestock use. Currently, only fluid and industrial milk are subject to regulation. The Canadian Dairy Commission is responsible for supply management and pricing of industrial milk whereas each provincial government is responsible for the fluid milk produced within its boundaries.

This division in responsibility is largely the result of two factors: 1) the intent of the British North America (B.N.A.) Act and 2) the characteristics of fluid milk and industrial milk products. It was the intent of the B.N.A. Act that the provinces assume responsibility for intraprovincial matters. Agricultural products both produced and sold in a province are considered a provincial responsibility. As fluid milk is bulky and perishable, sales have tended to be restricted to areas of production. Consequently, most of the fluid milk produced in each province is also sold within the province. On the other hand, cheese, S.M.P., and other miscellaneous dairy products are less bulky and perishable, and therefore more economically suited to interprovincial and international transport. Since interprovincial concerns fall under the federal government's jurisdication, the Canadian Dairy Commission, a federal commission, assumes responsibility for dairy policy and regulation of industrial milk.

The Industrial Milk Sector

The two main functions of the C.D.C. are milk supply management and milk pricing. In 1970, under the Comprehensive Milk Marketing Plan, a Market Sharing Quota Program was introduced so that the supply of industrial milk could be balanced to meet the national requirements. Under the Market Sharing Program, all industrial milk, including milk supplied by the fluid shippers for industrial purposes, is subject to supply management. Every year the national Market Share Quota (M.S.Q.) is based on estimates of Canadian requirements for butterfat plus a 5 to 10 percent tolerance (often referred to as a sleeve allowance). Each province is entitled to a share of the national M.S.Q. Annual provincial entitlements are dependent on the national requirement and the province's previous year's production. It is each province's responsibility to issue quota to all industrial and fluid producers shipping milk within the province for industrial purposes.

With regards to pricing, the objectives of the C.D.C. as stated in the Canadian Dairy Commission Act are:

> To provide efficient producers of milk and cream with the opportunity of obtaining a fair return for their labour and investment, and to provide consumers of dairy products with a continuous and adequate supply of dairy products of high quality.[1]

To achieve its first objective the Commission first determines what returns a producer should receive for a hundredweight of industrial milk and sets this as the "target" support price. Since 1975, a Returns Adjustment Formula has been used to determine the target support price

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[1] Canadian Dairy Commission Act, S.C. 1966-67, C. 34 51.

for a hundredweight of industrial milk. The formula as explained by the Canadian Dairy Commission is designed so that the 1975 base price is adjusted annually as production costs (index of dairy cash input prices) and labour earnings (consumer price index) change. These two components compose 80 percent of the weighting while the other 20 percent provides for a judgement factor. During 1978, the target support price was $12.42/cwt.

To ensure that the producers receive the target support price for their milk, the federal government has introduced 1) an offer-to-purchase program for butter and S.M.P. and 2) a subsidy payment program. Through the offer-to-purchase program, support prices for butter and S.M.P. are established. The government's offer to purchase these products at supported prices effectively sets the minimum market price at which processors purchase industrial milk. For instance, if the support price for butter and S.M.P. is $1.27/lb. and $0.74/lb., respectively, and on the average a hundred pounds of milk testing at a 3.5 percent butterfat level yields 4.2 lbs. of butter and 8.0 lbs. of S.M.P., the total value of the products derived is $11.25/cwt. From this value a processor's margin can be deducted and the producer's market price per hundredweight of milk determined. If a processing margin of $1.49/cwt was taken, producer market returns would be $9.76/cwt.[1]

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[1]The actual price producers receive for their milk depends on 1) the processing margin deemed adequate within each province, which may vary from that determined by the federal government, and 2) the pooled price which is a weighted average of the various end use prices (for instance, butter, cheese and S.M.P.).

In order that producer returns reach the target support price, the difference between the target support price and the market price is supplemented by a direct subsidy payment to the producers. Under the subsidy payment program, producers receive subsidies only to the extent of their M.S.Q. Whether they receive subsidies on all in-quota milk or only a portion thereof depends on the dairy policy during the particular year. A subsidy payment of $2.66/cwt for in-quota milk was paid during the 1978-79 dairy year.

Due to the federal government's policy of 1) regulating the supply of industrial milk to meet the national requirement in terms of butterfat and 2) maintaining producer target support price via the offer-to-purchase and subsidy programs, the supply of S.M.P. has come to exceed the domestic demand, making available an increased amount of S.M.P. for export. The disparity between world prices and higher domestic prices created by 1) the offer-to-purchase program and 2) the relationship between the world demand and supply forces the C.D.C. to assume the losses[1] incurred by selling S.M.P. at prices lower than for which it was purchased. To relieve the C.D.C. of these costs, both in-quota and over-quota levies were introduced to cover export equalization costs. In-quota levies pay the cost of exporting surplus S.M.P. from in-quota industrial milk, while the over-quota levy covers the cost of exporting surplus butter and S.M.P. processed from surplus industrial milk.[2] All producers with M.S.Q. are required to pay in-quota levies

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[1]These losses are often referred to as export equalization costs.

[2]The Dairy Control Board assumes the responsibility of collecting levies and issuing quotas in Alberta.

to the extent of their M.S.Q.; however, in Alberta, producers are not required to pay over-quota levies. Currently, the province is not producing to the full extent of its M.S.Q. entitlement. Consequently, the province does not wish to discourage production by charging over-quota levies for fear of a reduction in the provincial entitlement.[1]

The 1978-79 Dairy Policy

The main features of the 1978-79 dairy program[2] are:

1) the national requirement for industrial milk was estimated at 98 million hundredweight. With the inclusion of a 5 percent sleeve allowance, the national Market Sharing Quota remained unchanged from the previous year's quota of 103.7 million hundredweight.

2) the direct subsidy payment was to remain at $2.66/cwt and the export levy dropped twenty cents per hundredweight to $1.00/cwt. A contingency levy of $0.20/cwt is also to be collected from the producers to cover in-sleeve production disposal costs. If a producer produces under his in-sleeve allowance or if the in-sleeve allowance is required to meet the provincial requirements, the contingency levy will be refunded.

3) the target price was set at $12.42/cwt and the support price for butter and S.M.P. at $1.27 and $0.74/lb., respectively. This effectively sets the processors' margin at $1.49/cwt.

4) the over-quota levy was raised to $7.50/cwt from $7.00/cwt.

5) in an effort to attain a more uniform milk production pattern, the dairy year will be changed to begin August 1, starting August 1, 1979. The logic behind this is based on the fact that producers tend to cut back production as they approach the end of the dairy year in order to stay within the limits of their M.S.Q. With the dairy year beginning in August, producers may now have to reduce their milk shipments at a time when milk production is usually at a peak. For the next sixteen months quota will be allotted

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[1]The province's entitlement varies annually, depending on the national requirement and the previous year's production.

[2]Agriculture Canada, "Dairy Program Announcement," News, C-27 (Ottawa: Agriculture Canada, April 13, 1978).

to producers on a four month basis to ensure that the producers do not run out of quota before the sixteen month period has expired. Over-quota levies are to be charged on milk shipments exceeding the four month quota allotment.[1]

The Fluid Milk Sector

Since November 1, 1969, the Alberta Milk Control Board (A.M.C.B.),[2] formed under the Alberta Milk Act, has shared responsibility with the Public Utilities Board for the pricing and marketing of fluid milk. The A.M.C.B. is charged with the responsibility of establishing and enforcing regulations concerning production, processing, distribution and the sale of milk. The determination of minimum producer prices and consumer prices, however, falls under the Public Utilities Board's jurisdiction.

Like the industrial milk sector, the supply of fluid milk is regulated through the use of a quota system. One basic difference between the quota systems is that fluid producers are allotted a daily quota rather than an annual quota since daily quotas ensure a continuous stable supply throughout the year. In addition to fluid quotas, fluid producers are also able to procure Market Share Quota, the same quota allotted to industrial producers. New fluid producers are allotted a M.S.Q. equal to 13 percent of their fluid sales. Along with the quota entitlement, fluid producers receive the producer subsidy and are subject

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[1] In Alberta, over-quota levies are not collected. Currently, the province produces less than its market share and does not wish to discourage production for fear of losing a portion of its provincial market share entitlement to other provinces.

[2] Under the Milk Control Amendment Act, 1972, the name of the Alberta Milk Control Board was amended to the Alberta Dairy Control Board.

to export and contingency levy payments. As of January 1, 1975, a Graduated Entry Program was introduced whereby qualified industrial producers could acquire fluid milk quota on a graduated basis. However, once a producer has obtained a fluid quota, he must forfeit an equal share of M.S.Q. until his M.S.Q. equals 13 percent of his fluid milk sales.

In Alberta, fluid milk prices, like industrial milk prices, are determined by means of a pricing formula. The fluid pricing formula consists of eight components which consider producers' production costs, per capita consumption of milk, industrial wages, wholesale prices and consumer prices. The advantage of the formula to producers is that changes in producers' costs can be quickly translated into changes in the price of milk. Fluid producers received approximately $13.40/cwt in 1978.

CHAPTER III

VARIOUS APPROACHES TO SEASONALITY

Various plans and programs have been introduced by processors and government bodies to reduce seasonal milk fluctuations. Most of these plans and programs follow one of five methods or are combinations of the various methods. In this chapter, the characteristics, applications and success of the various approaches will be discussed to provide insight into the feasibility of and the possible complications that may arise in implementing a seasonal subsidy program. At the end of the chapter, a comparison of the five approaches will be presented (Table 3.6).

Approaches to Seasonality

The five methods that may be used to reduce seasonal milk fluctuations are: 1) seasonal price variations, 2) take-off and pay-back plans, 3) base excess plans, 4) quota plans, and 5) a seasonal milk pricing plan. Only the first four have been adopted in the United States and Canada, with varied success. The feasibility of the seasonal milk pricing plan has been studied using historical data but the method has not been implemented.

Seasonal Price Variation

Under a seasonal pricing method, lower prices are paid for spring produced milk and higher prices for fall milk. An example of this type of pricing pattern was observed by Roberts[1] in the Louisville

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[1] John B. Roberts, Louisville Fall-Premium Plan for Seasonal Milk Pricing, Bulletin 510 (Lexington, Kentucky: Kentucky Agricultural Experiment Station, November 1947), p. 23.

market region of Kentucky between 1932 and 1946. However, the seasonal prices he observed were not the result of a deliberate seasonal pricing pattern but the direct result of the seasonal demand and supply for milk in combination with the method of payment.

Between 1932 and 1946 milk was sold in the Louisville region on a milk classification and percent use basis. There were three milk classes, Class I, Class II and Class III, the prices of which were based on the value of Class III milk (industrial milk). The actual price that each producer received for his milk, however, depended on the percent utilization of the milk to each class by plants in the region. For example, suppose the utilization rate of Class I milk was 70 percent for the region and a producer shipped 400 cwt of Class I milk. The price he would receive for his milk is a blend price and is calculated as follows:[1]

1)	Price of Class I milk		\$ 13.40/cwt
	Price of Class III milk		\$ 9.28/cwt
2)	70% x 400 = 280 cwt	280 x \$13.40 =	3752.00/cwt
		120 x \$ 9.28 =	1113.60/cwt
		Total value =	4865.60
3)	Price per hundredweight shipped	=	12.16/cwt

Therefore, the lower the Class I utilization rate, the lower the blend price received by the producer.

Roberts indicated that there was a direct relationship between the level of Class I utilization and the supply and demand for milk. In spring when milk production was high and demand down, the utilization

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[1]The price of Class II milk was omitted for simplicity. Prices have been chosen for examplification and are not indicative of the prices received in the Louisville market in the 1930's and 1940's.

of Class I milk was low, thus resulting in a reduced blend price. Conversely, in fall when milk production was low and the demand for milk increased, the utilization of Class I milk was higher than that of spring. Therefore, producers received a higher blend price.

Between 1932 and 1942, the fall blend price exceeded the spring blend price by 15 to 20 percent (Table 3.1).[1] Roberts observed however, that fall produced milk as a percent of spring milk did not change appreciably between 1932 and 1942. Although seasonal price variations did not have any appreciable influence on the production pattern in the Louisville market, it does not mean that a seasonal price approach is ineffective. It may be that the percent variation between spring and fall prices were not large enough to induce dairymen to alter their production pattern.

Table 3.1--Total Volume of Milk for Fluid Consumption with Comparisons for April-May-June and September-October-November periods, Louisville Market Area, 1932-42.

Year	Pounds of milk received for period				Fall in percent of spring
	Annual	Apr-May-June	Sept-Oct-Nov	Difference, fall to spring	
1932 ...	106,268,383	32,784,672	22,212,653	-10,572,019	68
1933 ...	96,967,874	27,333,670	22,072,014	- 5,261,656	81
1934 ...	97,354,563	27,728,044	23,126,476	- 4,601,568	83
1935 ...	100,480,257	28,738,706	23,222,228	- 5,516,478	81
1936 ...	101,155,874	27,116,111	25,276,966	- 1,839,145	93
1937 ...	104,556,595	30,720,282	23,601,903	- 7,118,379	77
1938 ...	126,906,616	36,687,498	29,594,521	- 7,092,977	81
1939 ...	136,510,233	39,504,381	29,547,147	- 9,957,234	75
1940 ...	135,597,601	39,247,872	30,235,840	- 9,012,032	77
1941 ...	155,983,162	44,982,433	34,858,330	-10,124,103	77
1942 ...	163,746,304	47,539,188	35,977,095	-11,562,093	76

Source: John B. Roberts, Louisville Fall-Premium Plan for Seasonal Milk Pricing, Bulletin 510 (Lexington, Kentucky: Kentucky Agricultural Experiment Station, November 1947), p. 24.

[1]John B. Roberts.

Take-Off and Pay-Back Plan

Generally, the purpose of a "take-off and pay-back" plan is to encourage fall milk production without overstimulating spring production. To accomplish this an annually determined take-off rate is deducted from each hundredweight of milk shipped in the spring and reserved to pay premiums on fall produced milk. The advantage of this approach to seasonal milk fluctuations is that it does not interfere with the actual pricing of milk, although it does affect the price received by the producer.

This type of plan was introduced to the Louisville market in 1943 by the producers' association. In his review of the Louisville fall-premium plan, more commonly known as the "Take-Off and Pay-Back Plan", Roberts indicated that the plan was introduced in an attempt to reduce maladjustments in the supply and demand for milk. To modify the production pattern, a fall premium, paid out of a reserve fund earned through the application of a take-off rate on spring produced milk, was awarded to producers for each hundredweight of milk produced in fall. The guaranteed fall premiums were to provide incentives for fall production while the take-off deductions were to deter further increases in spring milk production.

Initially, the take-off rate for the Louisville plan was set at $0.15/cwt which was to be deducted in April, May and June. The funds collected were then paid to the Market Administrator to be held as a pay-back fund. The size of this fund depended on the take-off rate and the volume of milk shipped in the three months. The fund was divided into four equal amounts to be distributed in September, October, November and December. The rate of pay-back on each hundredweight of

milk delivered in each of the four months depended on the quantity of milk shipped in each month. During the first year of the plan, the producers received premiums of \$0.1247, \$0.1315, \$0.1455 and \$0.1403/cwt in each of these months above the blend price.

In 1944, the plan was revised to increase the take-off rate to \$0.20/cwt and the pay-back period adjusted to September, October and November. Since that time, adjustments to the plan have continuously been made to provide greater incentive toward fall production. In 1976, the take-off rates were \$0.20/cwt in March, \$0.30/cwt in April and \$0.40/cwt in May and June. The basis for making the pay-back payments was changed as well. Twenty-five percent of the fund was used to make August pay-backs, 30 percent for both September and October and 15 percent plus interest for November.

In his appraisal of the Louisville Plan, Roberts indicated that fall milk output increased faster than spring milk between 1945 and 1950; however, the same type of expansion also occurred from 1932 to 1936 before the plan was introduced (Table 3.2). Overall, the average fall production as a percent of spring production did not differ significantly between the periods 1932-1942 before the plan was introduced, and 1943-1952 when the plan was in effect. Consequently, it would seem that the plan was unsuccessful in encouraging a shift in production.

Roberts, however, indicated that the plan had arrested the trend toward wider variations in spring and fall production. He based his conclusions on a comparison of the Cincinnati market, which was not under a "take-off and pay-back plan", and the Louisville market.

Table 3.2--Estimated Total Volume of Milk for Fluid Consumption with Comparisons for April-May-June and September-October-November periods, Louisville Market Area, 1932-52.

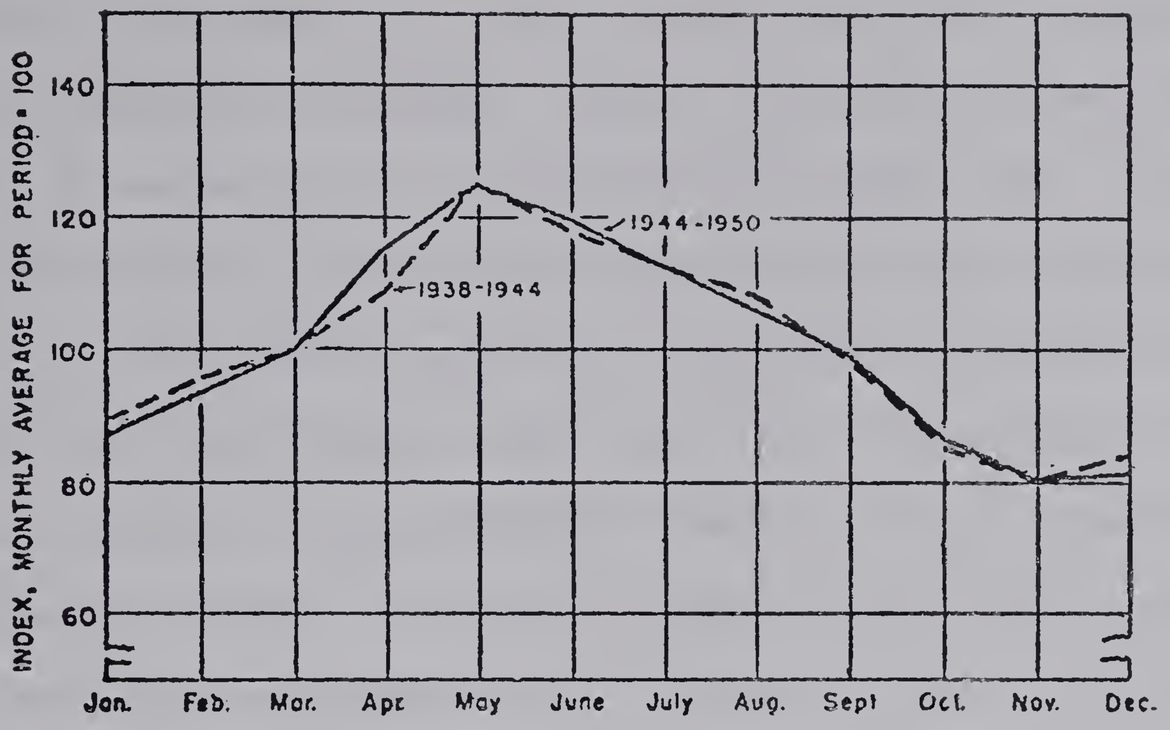
Year	Annual	April, May, June	Sept., Oct. Nov.	Difference fall to spring	Fall in percent of spring
1932 ...	106,268,383	32,784,672	22,212,653	-10,572,019	68
1933 ...	96,967,874	27,333,670	22,072,014	- 5,261,656	81
1934 ...	97,354,563	27,729,044	23,126,476	- 4,601,568	83
1935 ...	100,480,257	28,738,706	23,222,228	- 5,516,478	81
1936 ...	101,155,874	27,116,111	25,276,966	- 1,839,145	93
1937 ...	104,556,595	30,720,282	23,601,903	- 7,118,379	77
1938 ...	126,906,616	36,687,498	29,594,521	- 7,092,977	81
1939 ...	136,510,233	39,504,381	29,547,147	- 9,957,234	75
1940 ...	135,597,601	39,247,872	30,235,840	- 9,012,032	77
1941 ...	155,983,162	44,982,433	34,858,330	-10,124,103	77
1942 ...	163,746,304	47,539,188	35,977,095	-11,562,093	76
1943 ...	162,507,592	47,751,544	35,004,127	-12,747,417	73
1944 ...	170,378,346	48,364,603	41,111,937	- 7,252,666	85
1945 ...	184,218,490	55,331,912	39,478,426	-15,853,486	71
1946 ...	192,020,270	55,410,609	41,622,014	-12,788,595	75
1947 ...	199,100,094	59,874,994	44,113,673	-14,961,321	75
1948 ...	203,412,218	58,983,648	47,280,594	-11,703,054	80
1949 ...	230,088,207	67,643,657	51,898,788	-15,744,871	77
1950 ...	249,408,411	70,696,761	58,621,734	-12,075,027	83
1951 ...	236,275,486	68,234,514	54,836,011	-13,398,503	80
1952 ...	244,171,420	70,019,004	56,111,824	-13,907,180	80

Source: John B. Roberts and Grant Grayson, A Reappraisal of the Fall-Premium Plan of Milk Pricing in the Louisville Market, How it has Worked, 1944-52, Bulletin 602 (Lexington, Kentucky: Kentucky Agriculture Experiment Station, September 1953), p. 22.

The seasonal difference between the spring and fall production of 1944-1950 was greater than that of 1938-1944 for Cincinnati but it remained relatively constant for the Louisville market (Figure 3.1 and 3.2). This evidence is inconclusive, however. Although the Cincinnati market shares boundaries with the Louisville market and they have the same type of farming, some variables affecting only one market may have contributed to this difference.

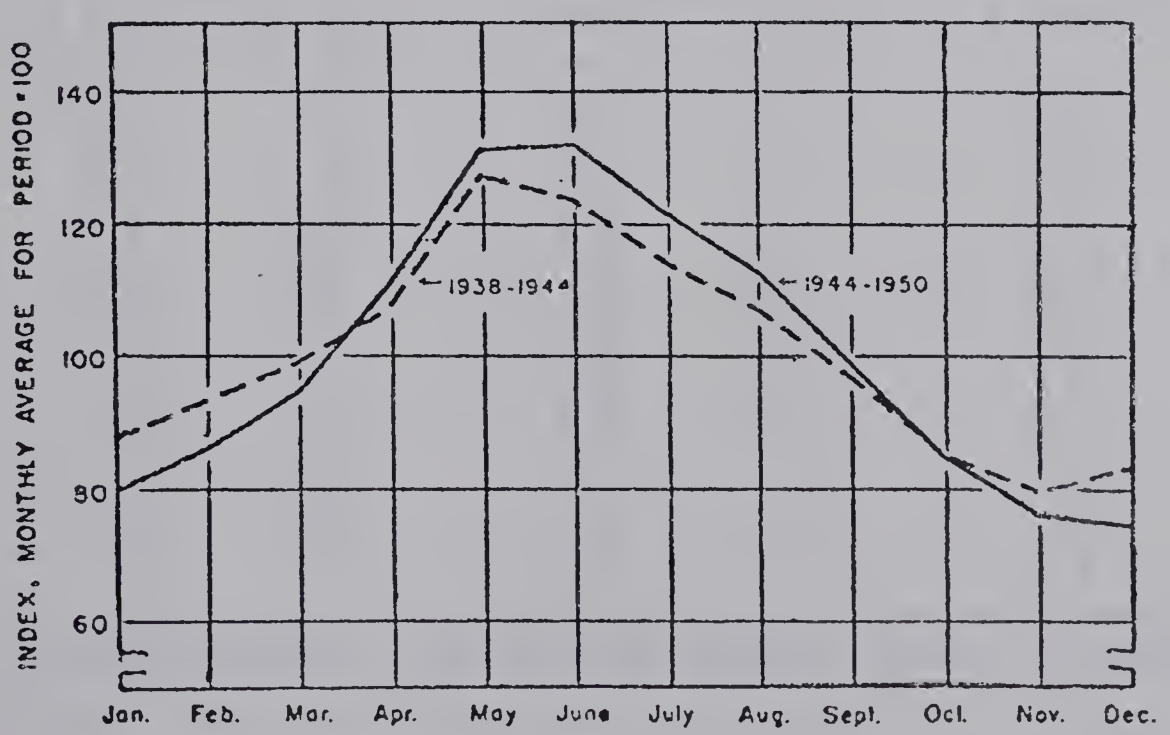
More recent information concerning the plan's effectiveness has

Figure 3.1--Index of Seasonal Production, Louisville Market, by Periods



Source: John B. Roberts and Grant Grayson, A Reappraisal of the Fall-Premium Plan of Milk Pricing in the Louisville Market, How it Has Worked, 1944-52, Bulletin 602 (Lexington, Kentucky: Kentucky Agricultural Experiment Station, September 1953), p. 23.

Figure 3.2--Index of Seasonal Production, Cincinnati Market, by Periods.



Source: John B. Roberts and Grant Grayson, A Reappraisal of the Fall-Premium Plan of Milk Pricing in the Louisville Market, How it Has Worked, 1944-52, Bulletin 602 (Lexington, Kentucky: Kentucky Agricultural Experiment Station, September 1953), p. 24.

been presented by Everett and Brace[1] (Table 3.3). Between 1965 and 1974 there was an improvement in percent seasonality: however, between 1974 and 1976, seasonality increased. Everett and Brace attributed this turnabout in seasonality to low take-off and premium rates. They hypothesized that producers were not encouraged to shift their production pattern as 1) the benefits associated with spring and summer milking outweighed the losses through deductions, and 2) the premiums did not adequately compensate the producer for the loss of net income realized by fall and winter milking. In order to reduce seasonal milk fluctuations, Everett and Brace recommended take-off rates of $1,00, $1.50, $2.00 and $2.00 during March, April, May and June, respectively, and pay-back rates of $1.90, $2.40, $2.40 and $1.40 during August, September, October and November, respectively.

Table 3.3--Percent Production and Percent Seasonality of Milk Produced in 1965, 1974, and 1976.

Month	1965	*	1974		1976	
	% prod.	% seas.	% prod.	% seas.	% prod.	% seas.
Jan.	8.1	- 3	8.2	- 2	8.2	- 1
Feb.	8.3	0	7.6	- 9	8.0	- 4
Mar.	9.1	+ 9	8.7	+ 4	8.9	+ 7
Apr.	9.4	+13	8.8	+ 5	9.0	+ 8
May	9.9	+19	9.4	+13	9.5	+14
June	9.6	+15	9.4	+12	9.0	+ 9
July	7.9	- 5	8.6	+ 3	8.4	0
Aug.	7.3	-12	8.2	- 2	8.0	- 5
Sept.	7.4	-11	7.9	- 5	7.7	- 8
Oct.	7.5	-10	7.9	- 5	7.9	- 5
Nov.	7.4	-11	7.4	-11	7.4	-10
Dec.	7.9	- 6	7.9	- 4	8.0	- 6

*Over- or underproduction from the 8.33 percent figure is called seasonality.

Source: R.W. Everett and Eugene Brace, "A New Milk Price Structure Could Help Solve the Seasonality Problem," Hoard's Dairyman (April 10, 1977).

[1] R.W. Everett and Eugene Brace, "A New Milk Price Structure Could Help Solve the Seasonality Problem," Hoard's Dairyman (April 10, 1977).

Base Excess Plan

Another approach that has been used to deal with seasonal milk fluctuations is the base excess plan approach. Generally with a base excess plan, the average daily delivery of a producer during a predetermined period (usually in the fall and winter when milk production is lowest) is designated as his base. In subsequent periods of milk deliveries, each producer is guaranteed the highest blend price, based on the utilization rate of Class I milk by the processors, up to the limit of his base. If his milk shipments should exceed his base, the excess is sold at industrial milk prices.

Such an approach as this was introduced by the processors in the Maine region during the 1950's to reduce seasonal surpluses of milk. The period extending from September through to December was designated as the base period and each producer's average daily shipments during this period determined his base. In subsequent periods each producer was paid a base price on his base milk. For example:

Assume a plant received 2,000 cwt of milk, 1,400 cwt of which is base milk. If the plant's utilization rate Class I milk is 1,200 cwt and the price of Class I and industrial milk is $13.40 and $9.28/cwt, respectively, then the price producers receive for their base milk is calculated as follows:

Base Milk Price:

1,200 cwt (Class I utilization rate) X $13.40/cwt	= $16,080.00
200 cwt (surplus base milk) X $9.98/cwt	= $ 1,856.00
Total value	= $17,936.00
Base price received for milk	12.81/cwt

Therefore all producers receive $12.81/cwt for base milk (1,400 cwt) and $9.28/cwt for excess milk (600 cwt).

As each producer's base establishes the maximum volume of milk for which he is able to receive the highest pool price, it may be to each producer's advantage to produce as much milk as possible during the base period. Since the base period is usually when milk production is lowest, an increase in milk production results. Depending on the marginal cost of producing milk over the base limit and the current industrial milk price, the base excess plan could effectively reduce the quantity of milk supplied to an overloaded summer market.

A comparison done by Latimer[1] of a base excess plan implemented in the Middle Atlantic region and the take-off and pay-back plan in the New York-New Jersey area disclosed that the best 1972 fall-to-spring ratio achieved under the take-off and pay-back plan was 78 percent, while 95 percent was achieved under the base excess plan. The study of these two market areas also revealed that milk prices tended to be higher when a base excess plan was used. This was largely due to the method used in calculating producers' prices. Under the base excess plan, the base price was determined on the basis of the designated winter base and the utilization rate of the base milk and was unaffected by the level of milk shipped in excess of the base level. As a result of this method of payment, only those producers supplying summer milk in excess of their base level received low industrial rates on that excess. Prices tended to be lower under the take-off and pay-back plan

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[1] Robert G. Latimer, "Seasonal Incentive Pricing," Dairy Herd Management (December 1973), pp. 26-28.

since they were based on the total production of all producers (rather than the base level) and the utilization rate of Class I milk. Since milk in excess of Class I utilization (i.e., that which receives low industrial prices) was used in calculating the blend price, producers tended to receive lower prices for their milk in summer when quantities of milk were supplied in excess of the plant's need for Class I milk.

In order to reduce seasonal milk fluctuations, a base excess approach was also begun by the Manitoba Milk Producers Marketing Board in 1974 under the title of the Dairy Entitlement Program.[1] This program was introduced 1) to provide milk shippers with an incentive to produce milk more uniformly year round, and 2) to protect producers who ship uniform amounts year round against reduced Grade A milk prices in the spring and summer, as a result of high milk production.

Under the Manitoba Daily Entitlement Program, a producer's base is established during the base period extending from September 1 through January 31. A producer's average daily delivery for this period plus a 20 percent increment constitute his daily entitlement. Each producer is guaranteed the highest pool price for his milk up to the limit of his daily entitlement for the subsequent seven months. Milk shipped in excess of the daily entitlement is paid industrial milk prices.

When the Manitoba Daily Entitlement Program was devised, the policy makers realized that it would take time for the producers to adjust their production patterns. Consequently, a three year adjustment period was incorporated into the Program. During the first year of the

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[1]"Manitoba Milk Producers Marketing Board: Daily Entitlement," April 18, 1977. (Mimeograph.)

plan, the producers received the highest pool price on all their summer milk. Their daily entitlement for the next year, determined between September 1, 1974 and January 31, 1975, was based on their average daily deliveries and a 65 percent increment. Over the next two years, the incremental allowance over average daily deliveries was reduced to 50 percent, then to 20 percent. In spite of these adjustments, Manitoba has reported that "producers responded to the necessary production cut-backs in the early part of the dairy year and maintained their production at a satisfactory level during the fall months."[1]

Quota Restrictions

Milk quotas restrict the volume of milk a producer can ship during a particular period. Depending on the duration of the period and the application of restrictions, quotas either regulate total annual milk production or adjust for seasonality. Quotas restricting the volume of milk shipped annually do not reduce seasonal milk fluctuations because the quota restrictions apply for too long a period. To adjust for seasonality, quota restrictions must apply over a briefer period if the timing and the volume of milk shipments are to be controlled.

Quota restrictions set to adjust for seasonality can be applied in two ways. First, quota restrictions applying to several periods over the year could be implemented. For instance, trimester quota restrictions could be imposed so that the total volume of milk that any producer shipped during each trimester was restricted. Trimester quota restrictions on industrial milk production were implemented in 1978 in

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[1] *Ibid.*, p. 2.

Canada, as a result of the government's decision to change the beginning of the dairy year to August 1 from April 1. Basically, the purpose of trimester quotas was to provide producers with M.S.Q. until August 1, 1979 when the new dairy year begins. However, if trimester quotas are continued beyond this point as a means of reducing seasonal milk fluctuations, their success will depend on whether producers are penalized for over-quota milk. Currently, the Alberta Dairy Control Board is not penalizing over-quota production as Alberta is producing less than its annual M.S.Q. allotment.

Instead of restricting milk production year round, an alternative would be to restrict milk shipments in the spring and summer only. This was the approach used in a dealer-imposed quota plan in Maine in the 1950's.[1] Various quota plans in Maine restricted milk shipments in either the April, May and June period or from January to August to reduce milk surpluses. Producers were paid the blend price for quota milk but were unable to sell their excess milk unless it was either required by the dealer or shipped as farm separated cream. Quota plans differ from base excess plans in that a producer can only deliver up to his quota and not in excess of, as in a base excess plan.

The main criticisms made against the quota plans introduced in Maine were 1) they did not allow producers any flexibility in scheduling their production patterns, and 2) the price received under the quota plan was lower than under the base excess plan. Irrespective of the complaints made against the plans, the quotas did seem to reduce

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[1]H.B. Metzger, Milk Pricing Under Seasonal Quota Plans--Attitudes Toward the Plans and Their Effect on Income, Bulletin 586 (Maine: Maine Agricultural Experiment Station, October 1959), p. 18.

seasonal milk fluctuations.

Figure 3.3 illustrates the effectiveness of the quota plan introduced in the Bangor, Maine region during 1957. As the average daily milk delivery between September 1957 and January 1958 determined each producer's quota, the 1958 fall production increased to exceed the previous year's fall production. The peak in milk deliveries usually experienced in spring and summer was eliminated in 1958 and shifted to the fall.

The imposition of a quota plan between 1938 and 1944 in the Evansville, Indiana market also proved effective (Figure 3.4). The seasonal fluctuations were narrower when the quota system was in operation between 1938-1944 than between 1944-1950 when there was no quota plan.

Seasonal Pricing Plan for Milk

The seasonal pricing plan suggested by Sargent Russell[1] in 1967 is a deductions and premiums approach to seasonality. Under such a plan, premiums and deductions to be assigned to each producer would be dependent on the producer's contribution to the milk market imbalance. Producers contributing heavily to market imbalance would be levied a penalty charge against each hundredweight of milk shipped. On the other hand, producers delivering milk on a more uniform year round basis would be awarded a premium on their milk shipments.

Russell proposed that the degree to which producers contribute to market imbalance be determined through the use of a statistical

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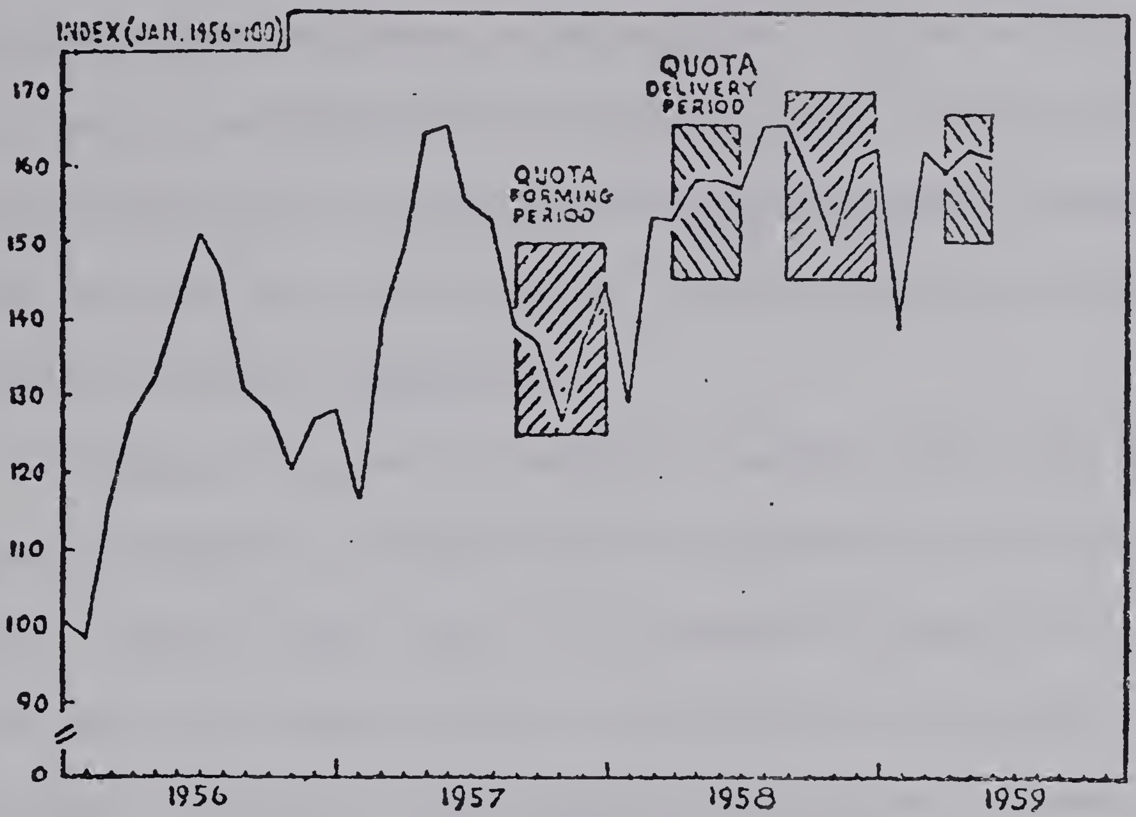
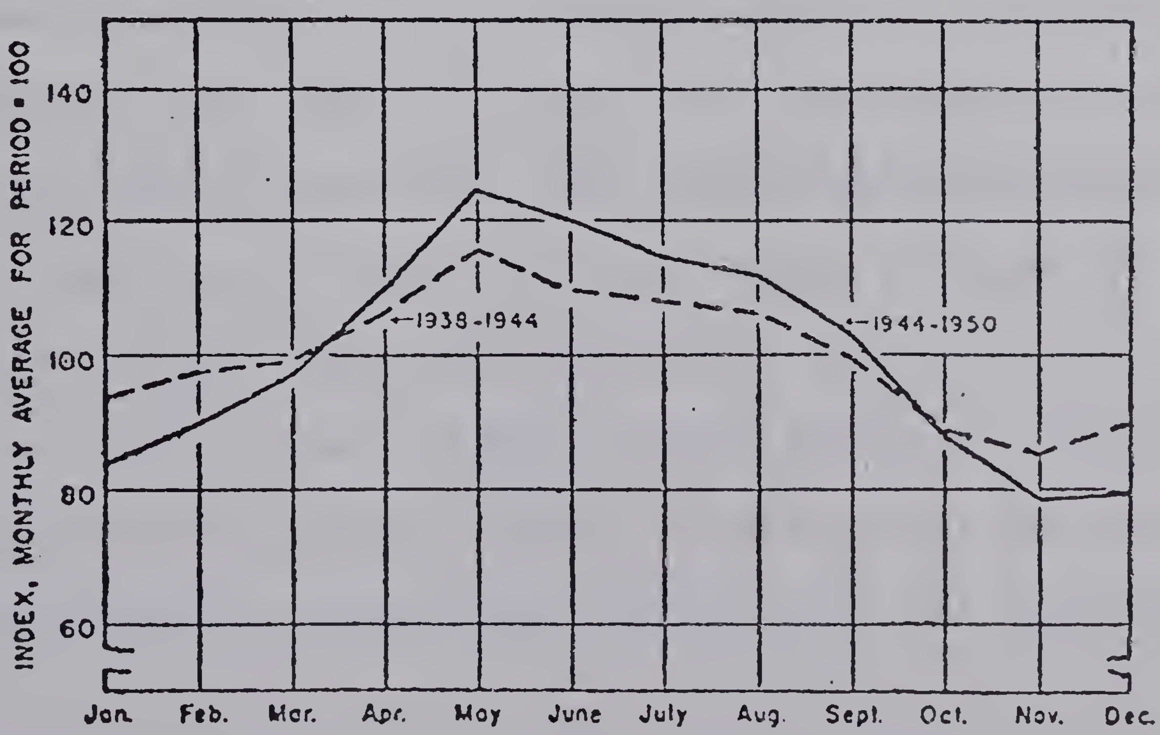
[1] Sargent Russell, pp. 643-655.

Figure 3.3--Indexes of Total Monthly Deliveries of Milk by Producers, Before and After Imposition of Quota Plan, Bangor, Maine.



Source: H.B. Metzger, Milk Pricing Under Seasonal Quota Plans--Attitudes Toward the Plans and Their Effect on Income, Bulletin 586 (Maine: Maine Agricultural Experiment Station, October 1959), p. 18.

Figure 3.4--Index of Seasonal Production; Evansville Market, by Periods.



Source: John B. Roberts and Grant Grayson, A Reappraisal of the Fall-Premium Plan of Milk Pricing in the Louisville Market, How it Has Worked, 1944-52, Bulletin 602 (Lexington, Kentucky: Kentucky Agricultural Experiment Station, September 1953), p. 25.

measurement, the coefficient of variation. The coefficient of variation measures the deviation between each producer's actual monthly milk shipments and an expected monthly shipment base.[1] As the deviation between the actual milk shipments and expected monthly shipment increases, so does the coefficient of variation and thus the producer's contribution to market imbalance.

To induce producers to conform to market needs, Russell devised a premium and deduction schedule based on producer's coefficient of variation. Russell noted that if the method of payment associated with this plan was to be kept separate from other pricing systems, the premiums must be paid with the deductions collected. Consequently, they must be equal. Based on the coefficients of variation determined for New England Milk producers (1959-1962), Russell devised two methods of payment meeting this criterion.

The first method tied the deductions and premiums to equal proportions of milk deliveries. To do this, Russell suggested that the producers' coefficients of variation be arranged in numerical order and divided into fifty steps so that each step represented 2 percent of the total milk supply (Table 3.4). Only those producers with coefficients between steps one and twenty-five would receive premiums for their milk. With each of these steps the premiums would increase by $0.01/cwt until the premium payment of $0.25/cwt was reached at the last step. To ensure that the premiums equalled the deductions, the incremental change in deductions between each step was also kept at one cent.

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[1]The expected monthly shipment base depends on the desired milk supply pattern. If a uniform milk supply is required, each producer's average monthly delivery can be used as an expected monthly shipment base.

Table 3.4--Premiums and Deductions for Coefficient of Variation Ranges which Cover Two Percent of Total Milk, New England, 1961-62.

Premium	Coefficient range	Deduction	Coefficient range
cents per 100 pounds		cents per 100 pounds	
1	19.4-19.6	1	19.7-20.0
2	19.0-19.3	2	20.1-20.4
3	18.7-18.9	3	20.5-20.8
4	18.3-18.6	4	20.9-21.2
5	17.9-18.2	5	21.3-21.6
6	17.5-17.8	6	21.7-22.1
7	17.1-17.4	7	22.2-22.5
8	16.7-17.0	8	22.6-23.0
9	16.3-16.6	9	23.1-23.5
10	15.9-16.2	10	23.6-24.1
11	15.5-15.8	11	24.2-24.7
12	15.1-15.4	12	24.8-25.5
13	14.6-15.0	13	25.6-26.2
14	13.9-14.5	14	26.3-27.0
15	13.3-13.8	15	27.1-27.8
16	12.7-13.2	16	27.9-28.6
17	12.0-12.6	17	28.7-29.5
18	11.3-11.9	18	29.6-30.5
19	10.4-11.2	19	30.6-32.0
20	9.5-10.3	20	32.1-33.5
21	8.4- 9.4	21	33.6-35.5
22	7.0- 8.3	22	35.6-38.3
23	5.6- 6.9	23	38.4-43.0
24	3.6- 5.5	24	43.1-48.5
25	Up to 3.5	25	Over 48.5

Source: Sargent Russell, "The Seasonal Pricing Plan for Milk," Journal of Farm Economics, Volume 49, Part 1 (1967), p. 651.

The alternative method of payment suggested by Russell was to tie the deduction and premium payments to a constant change in coefficients rather than to equal proportions of milk shipments (Table 3.5). With this method of payment, a change of one in the coefficients of variation would mean a one cent change in payment. To ensure that the premiums equalled the deductions, the cutoff point between the premiums and deductions has to be determined. However, this coefficient

can only be determined through a trial and error process. For each coefficient step, the volume of milk associated with it must be multiplied by the corresponding premium or deduction and the premiums and deductions summed until a coefficient is reached that equates the two.

Table 3.5--Percent of Milk Deliveries by Coefficient of Variation, New England, 1961-62.

Coefficient of Variation	Percent of Milk	Coefficient of Variation	Percent of Milk	Coefficient of Variation	Percent of Milk
Below 6	4.00	21	4.64	36	0.80
6	1.28	22	3.95	37	0.68
7	1.46	23	3.75	38	0.58
8	1.68	24	4.36	39	0.48
9	1.89	25	2.82	40	0.40
10	2.12	26	2.68	41	0.40
11	2.45	27	2.53	42	0.40
12	2.85	28	2.35	43	0.40
13	3.35	29	2.17	44	0.40
14	3.95	30	1.99	45	0.40
15	4.64	31	1.54	46	0.40
16	4.90	32	1.38	47	0.30
17	5.09	33	1.23	48	0.30
18	5.24	34	1.07	49	0.30
19	5.36	35	0.94	Above 49	1.70
20	5.40				

Source: Sargent Russell, "The Seasonal Pricing Plan for Milk," Journal of Farm Economics, Volume 49, Part 1 (1967), p. 652.

Under this method of payment, the premiums and deductions tend to be less. This can be attributed to the fact that a large proportion of the milk was supplied by producers whose coefficients of variation were distributed around the central coefficients where the premiums and deductions per hundredweight of milk were lowest.

Russell compared the prices under his suggested plan to the seasonal pricing system in the New England region. Under the seasonal

pricing system, the spread in the prices received by farmers having twelve different production patterns was only twelve cents. In 1959-60, seasonal production resulted in only a $736.00 gross income spread and a $620.00 and $514.00 spread for 1960-61 and 1961-62, respectively for producers with different production patterns. The seasonal price spread was not wide enough to affect gross income appreciably; therefore, an incentive encouraging producers to alter their production patterns was lacking. However, when Russell adjusted the existing seasonal prices for each production pattern by the appropriate premium and deduction rate, the price spread was increased to thirty-four cents. Whether this price spread was wide enough to induce producers to alter their production pattern was not determined.

The eventual outcome regarding to whom the benefits of uniform production accrue was one of the problems Russell pointed out. As producers adjusted their production patterns and milk shipments became more uniform, the basis for deductions and premiums would disappear. Although the costs associated with seasonality (for example, the deductions and the higher costs of fall and winter production) were borne by the producers under the premium and deductions approach, some of the producers did receive some compensation. However, once uniform milk production was achieved, the producers bore the brunt of the costs, and the benefits accrued totally to the processors.

Summary of Approaches

An overall summary of the administrative responsibilities, characteristics, limitations and criticisms of the five approaches discussed are presented in Table 3.6. Although none of the five

approaches discussed were designed to deal with the fluctuations in industrial milk supply, some of the problems found to arise with the use of these approaches could provide insight into the possible complications that may arise upon the introduction of a seasonal subsidy program.

Table 3.6--A Comparison of the Five Approaches.

Characteristics	Seasonal Pricing (Louisville)	Take-Off Payback Plan (Louisville Plan)	Base Excess Plan (Daily Entitlement)	Quota Plan (Evansville)	Deductions and Premium (Seasonal Pricing Plan)
Introduced by	Federal order	Producers' association	Producers & processors	Processors	Not yet implemented
Administrative Responsibilities	Processors	Market administrator	Processors	Processors	Could be either government or processors
Restrictions, Price or Quantity Oriented	Price	Price	Price and quantity to a degree	Quantity	Price
Price Basis	Milk class utilization	1) Class utilization 2) Take-off rate 3) Milk shipped during the take-off and payback periods	1) Class utilization 2) The quantity of base milk held by a producer 3) Excess milk supplied by the producer	Class utiliz-ation	1) Class utilization 2) The deduction or the premium associated with each producer's coefficient of variable
Discriminatory Pricing between Producers	None--producers receive the going price; however, their revenue will vary according to the production pattern	None--producers receive the going price; however, their revenue will vary according to the production pattern	Partially--all producers receive the base price for base milk; however, the average price that each producer receives for his milk depends on the quantity of excess milk shipped and the price of industrial milk	None--all receive the going price	Completely--producers contributing to seasonal are penalized through deductions whereas producers with less fluctuating supplies are awarded premiums for every hundredweight of milk shipped
Limitations	Prices based on a utilization basis did not allow for a wide enough price spread to discourage a seasonal product-ion	As all producers move toward more uniform production, the deductions each farmer pays will more closely equal the premiums he will receive. Conse-quently, there will be no incentive to maintain uniform production	Could lead to summer milk' shortages	Problems result in excess milk disposition	Once uniform production has been achieved, the plan breaks down as the premiums can no longer be paid out of the deductions
Criticisms	Seasonal prices applied to all producers and were not directed against those small summer producers who contributed to seasonality	1) Seasonal prices applied to all pro-ducers and were not directed against those small summer producers who contributed to seasonality 2) The payback and take-off rates were not large enough to discourage summer production	Producers often found the plan confusing	Producers complain of lack of flexi-bility in adjusting their production pattern	None made to date

Source: Summarized by author.

CHAPTER IV

METHODOLOGY OF EVALUATIONS

Part I: Methodology for Evaluation of a Seasonal Subsidy Program

The first objective of the thesis was to evaluate the effectiveness of seasonal subsidy rates as a means of inducing industrial producers to increase their level of winter milk sales. To fulfill this objective it was necessary to first obtain information concerning the summer and winter production costs of industrial milk and secondly, to propose a winter and summer subsidy rate on which the evaluation could be based. Information concerning industrial producers' costs of production was sought to determine the differential between winter and summer costs of industrial milk production. The differential determined thus provided the basis for the proposed subsidy rates on which the effectiveness of seasonal subsidy rates were evaluated.

Communications with the federal and provincial Departments of Agriculture and the C.D.C. revealed that cost of production statistics for industrial milk were nonexistent. Although Alberta Agriculture (A.D.A.) collects information pertaining to fluid milk shippers, it was felt that such a data base could not be applied to industrial shippers for many reasons. One reason being, the distribution of fluid shippers according to size varied significantly from the distribution of industrial producers (Table 4.1). Approximately 28 percent of the industrial producers in the province shipped over 10,500 pounds of butterfat as opposed to 89 percent of fluid producers.

Table 4.1--Number of Producers and Amount of Butterfat Shipped at Specific Level of Shipments, Alberta, 1976/77.

Size according to pounds of butterfat	Industrial Producers		Fluid Producers	
	Numbers	Percent	Numbers	Percent
Less than 5,499	299	27.58	27	2.7
5,500-10,499	471	43.45	111	11.1
10,500 and more	314	28.47	861	89.19

Source: Canadian Dairy Commission, "Number of Producers and Butterfat Shipped at Specific Levels of Shipments, 1976/77" (Ottawa: February 7, 1978). (Mimeograph.)

In many farming operations, including dairy operations, there is evidence of economics of scale, that is, the cost of each unit of output decreases as the output of the farm increases. This can be the result of several factors, for instance, the operation's ability to utilize expensive technological developments (i.e., machinery) or through the specialization of labour. If smaller dairy operations such as industrial milk operations are incapable of utilizing expensive technological developments, their costs of production per unit of output may be greater than fluid producers who tend to have larger shipments. For instance, milking parlours are labour saving devices. If only large farms are able to economically utilize such devices, smaller farms may have to resort to hand milking which requires more labour hours. Consequently, if the size of the dairy operation, as measured by output, affects the cost per unit of output, fluid costs of production may not be representative of industrial milk production costs.

Another reason why A.D.A.'s fluid milk data base could not be used was the nature of the quota systems regulating the supply of

industrial and fluid milk. The M.S.Q. regulating the supply of industrial milk is an annual quota, whereas the fluid shippers have a daily quota that must be met or they lose a portion of their quota entitlement. Therefore, the extra costs fluid shippers incur in maintaining an even flow of milk are not generally incurred by industrial producers.

As information concerning the costs of industrial milk production were nonexistent, data on industrial producers' costs of production were collected through a joint effort of the Production Economics Branch of Alberta Agriculture and the author. A questionnaire was used to collect the data. The questionnaires were delivered to each producer personally rather than by mail. This allowed the enumerator to 1) explain the purpose of the questionnaire, 2) make certain that the producer understood what was expected of him as a participant in the survey, 3) deal with problems the producer encountered in answering the questions, and 4) make certain that all questions were answered in the right context.

The questionnaire used for this survey was that used by A.D.A. for their fluid shippers survey (Appendix A). Although the questionnaires are usually issued monthly to the fluid producers, it was deemed sufficient to issue them on a quarterly basis to the industrial producers. This decision was based on the length of time required to answer the questionnaire and the needs of the study. Producers were required to answer four questionnaires to cover the calendar year, 1977. Both time and financial constraints limited this study to one year.

Design of the Questionnaire

The questionnaire consisted of forty structured questions. The producers were to answer the questions in monetary and/or physical terms. Since this study was an enterprise analysis, the producers were requested to give their costs on a total farm basis with the dairy portion specifically identified. Aside from the quarterly questionnaires, the producers were also requested to fill out a capital investment sheet inquiring into their assets (Appendix A). Each producer was to list his assets in the appropriate section, state the date of purchase, its initial cost and its contribution to the dairy operation as a percentage of the total farm. Information regarding livestock, crops and supplies were also requested.

Information concerning the value of an operator's labour, livestock, feed and capital assets was not requested. Although producers may have some notion of the value of their assets and inputs, if they have not recently dealt in the market for these inputs, they may be unable to provide the correct current value. Therefore, a value was assigned to the various inputs and assets according to regional price information provided by the provincial government (Appendix B). The values assigned to a producer's various capital investments were calculated by multiplying the cost of the asset at the time of purchase by a conversion factor to give the 1977 beginning value. To obtain the conversion factor, the inflation index was multiplied by the depreciated value of the asset. Not all assets were valued using the same conversion factors since the inflation and the depreciation rate of various types of assets were not the same.

The Sample

Producers were selected from an industrial milk shippers sample selection list. Regional location was used as the basis for categorizing the producers and the participants were chosen so that each region in Alberta would be represented. The five regions represented were the North West, North East, North Central, South Central and Southern region.

The criteria used in choosing the participants were: 1) that they be industrial milk producers holding M.S.Q., 2) that each producer considered dairying to be his main enterprise, 3) that each producer have a minimum of 9,000 lbs. of M.S.Q., and 4) that each producer have no more than 400 lbs. of fluid quota. The 9,000 lbs. market share quota limit was incorporated since a producer holding less than 9,000 lbs. probably could not make a living solely from his dairy operation. A 400 lb. upper limit on fluid quota was chosen as this is the maximum amount that each producer is allotted during the first year of entry to the Graduated Entry Program. Any producer holding more than 400 lbs. may not have costs representative of industrial producers as he is in the process of transition from an industrial shipper to a fluid shipper.

Several producers from each region were contacted by telephone and asked if they would like to participate in the study. Due to the difficulty encountered in procurring willing participants, the Red Deer district agriculturalist was contacted and asked if he could recommend any industrial producers that might participate. The enumerator then contacted the recommended producers. A meeting with the district agriculturalist was arranged so that the enumerator could be introduced to the producers and allowed to explain more thoroughly the purpose of the study.

Twelve producers were originally sampled but two withdrew from the study due to the amount of time involved in answering the questionnaires. It is fully realized that ten is a small sample size especially when the population consists of 1,089 producers. However, monetary and time constraints and the difficulty experienced in recruiting participants limited the size of the sample. This study, however, can be considered a pilot study for further research.

Several factors are important in determining a sample size representative of the total population. One of the factors determining the size of the sample is the degree of confidence chosen. For instance, a 95 percent confidence level requires a larger sample than a 90 percent confidence level. In this study, a 95 percent confidence level may be an unwarranted criterion for estimating sample size as much of the data collected is based on the producers' best estimates of their costs and returns. A 90 percent level of confidence may be more appropriate given the likelihood of errors in the estimates. A second factor influencing the size of the sample is the maximum allowable error tolerated in determining the parameter in question, in this case the mean variable cost of production per hundredweight. The total allowable error in the study was estimated at $0.52,[1] 6 percent of the mean cost of production per hundredweight. This results in a standard error of $0.265. If the

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[1] $n = \dfrac{s^2}{s_{\bar{x}}^2}$ and $s_{\bar{x}} = \dfrac{\text{total allowable error}}{\text{standard deviate for the degree of confidence (1.96)}}$

where: n = sample size (10), $s_{\bar{x}}$ = standard error of the mean, and s^2 = variance (.714)

maximum error acceptable was reduced to $0.25 or $0.10 (2.8 or 1.1 percent of the mean cost of production per hundredweight, respectively), the sample size would have to be increased to 43 and 274, respectively. A third factor that will affect the size of sample chosen is the variance determined in a pilot study. As the variance increases so must the sample size if the maximum tolerable error level is to be maintained. Generally, the more homogenous the population, the smaller the variance. Consequently, the size of the sample required is smaller.

Treatment of the Data

The data gathered from the questionnaires were compiled and weighted averages representing the producers' costs and receipts for the winter and the summer were derived. The cost components of this dairy cost and returns summary were divided into two sections, the fixed costs and the seasonally variable costs. The difference between the total weighted average summer and winter variable costs of production[1] was established, thus providing the basis for the proposed subsidy rates on which the evaluation was based.

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[1]The fixed cost component was not considered in determining the subsidy payments as fixed costs should not affect the producer's decision concerning the volume of milk to produce each period. Leftwich explains why fixed costs do not affect production decisions.

> "Total fixed costs refer to the entire obligation per unit of time incurred by the firm for fixed resources. Since the firm does not have time to vary quantities per unit of time of fixed resources used, total fixed costs will remain at a constant level regardless of the output produced per unit of time."

Richard H. Leftwich, The Price System and Resource Allocation (4th ed.; Hinsdale, Illinois: Oklahoma State University, November 1969), p. 148.

Evaluation of the Effectiveness of Seasonal Subsidy Rates

Basic to the evaluation of seasonal subsidy rates is the assumption that rational producers would only be induced to adjust their milk production pattern if there was economic justification for doing so. Thus, to determine the likelihood of production adjustments, expected producer returns under various production patterns and the proposed subsidies were studied. Apart from the direct effect of the proposed subsidy rates on producer returns, there are indirect effects dependent on the policies and conditions stipulated in the administration of seasonal subsidy rates. Both the policy options and the conditions chosen can affect the subsidy payments, and thereby net returns, producers receive within each season. Thus, in the evaluation of the effectiveness of subsidy rates, two policy options are considered to illustrate 1) the effect of the policy options and their attendant conditions, 2) the proposed subsidy rates, and 3) various production patterns on producer returns.

Limitations

Both federal policy regarding national M.S.Q. and weather can affect milk production. Since the approach used in determining the industrial producers' costs of production was cross-sectional, the seasonal cost differences obtained depict only what occurred in 1977 and cannot be construed to apply generally. A time series approach might incorporate the variable effects weather and policy have on milk production and allow generalizations to be made concerning seasonal cost differences.

Part II: Methodology for Evaluation of a Seasonal Pricing Plan

The seasonal pricing plan for milk[1] was devised to reduce seasonal milk fluctuations by penalizing or rewarding each producer according to the variation between his actual and expected monthly milk shipment. Each procuer's variation between his actual and expected monthly milk shipments was measured by means of his coefficient of variation. The coefficient of variation is a statistical term which measures relative dispersions. In this case, the coefficient of variation was used to measure the deviation between actual milk shipments and expected monthly milk shipments. The formula[2] used for calculating the coefficient of variation is :

$$\text{Coefficient of Variation} = \frac{S}{\overline{X}}(100)$$

where: $$S = \sqrt{\frac{\Sigma\,(X_c - \overline{X})^2}{n}}$$

S = standard deviation

n = number of months

$\overline{X}$ = expected monthly milk shipment[3] calculated as 28.57 x M.S.Q./12

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[1]Sargent Russell.

[2]Robert D. Mason, Statistical Techniques in Business and Economics, ed. Robert B. Fetter (3rd ed.; Homewood, Illinois: Richard D. Irwin, Inc., 1974), p. 120.

[3]As M.S.Q. are distributed on a butterfat basis and the data collected were on a hundredweight basis, it was necessary to convert M.S.Q. to a hundredweight basis. Assuming a 3.5 percent level of butterfat per hundredweight, a conversion factor of 28.57 is obtained (100/3.5 = 28.57).

X = actual monthly milk shipment

X_c = X (percent fat/3.5)

X_c = fat correction for milk[1]

In order to determine the feasibility of implementing Russell's seasonal pricing plan for milk in Alberta, data were collected concerning industrial producers' monthly milk shipments. This was necessary to determine the range of coefficients of variation for producers in the province and their distribution within the coefficient range. Information concerning monthly milk shipments was collected from five processing plants in the Central Alberta region. The plant's proximity to Edmonton and the extent of management's cooperation dictated which plants were selected. Three of the five plants were strictly industrial plants, whereas the other two plants were involved in fluid processing as well.

Information was collected on all the plants' 395 industrial shippers. The volume of milk shipped monthly by each shipper and the corresponding fat test over 1976 and 1977 was recorded from the plant's monthly statements. Each producer's corresponding M.S.Q. for 1976 and 1977 was also recorded. A file was then created for each producer sampled documenting monthly shipments, the corresponding butterfat test, and the size of M.S.Q. during 1976 and 1977. This information

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[1]As the level of butterfat in raw milk varies, it was necessary to incorporate a butterfat correction factor so that milk shipments between producers were comparable on a butterfat basis. All milk shipments were corrected to a 3.5 percent butterfat test which is considered the average test level for raw milk.

was then used to determine each producer's coefficient of variation.

Only those producer files with twelve milk shipment entries per year were used to compute producer coefficients of variation. This was done to avoid the introduction of bias. Several sources of bias could have been introduced had incomplete records been utilized:

1) New entrants or producers leaving the industrial milk market could be considered atypical of industrial producers. Inclusion of their coefficients of variation could bias the results upward and downwards in the case of new entrants and former industrial producers, respectively. Unless they entered or left the industrial milk market at the end of a record year, these producers were detected by missing data entries and their files were omitted from the analysis.

2) Unforeseen circumstances such as death or illness of the producer or cattle could also disrupt milk shipments and bias the coefficients. If shipments were discontinued or disrupted for more than one month, a producer's file was not used.

3) A single large deviation between actual and expected monthly shipments has a greater influence on the coefficient of variation calculated when there are fewer than twelve shipment entries per year. Incorrect conclusions may be drawn regarding a producer's shipping pattern if his coefficient of variation is calculated using fewer than twelve entries.

Once the sampled producers' coefficients of variation had been derived, they were arranged in numerical order and divided into fifty

steps, each representing 2 percent of the total milk produced.[1] According to the structure of the plan outlined by Russell, those producers with coeffccients of variation in the first twenty-five steps would receive premiums for their milk upon implementation of such a plan. Conversely, producers whose coefficients are in the last twenty-five steps would be required to pay a penalty. The dispersion of the producers was then listed to determine the number of industrial producers who would receive premiums and incur deductions if such a plan was adopted. Based on this information 1) further analysis concerning relationships in producer size and market imbalance, as measured by each producer's coefficient of variation, was tested, and 2) the implications of their relative dispersion over the premium and deduction range assessed.

To determine whether there was any relationship between the coefficient of variation and a producer's size, a Pearson Correlation Test was undertaken. The existence of an inverse relationship between

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[1] The range of each coefficient step, which represents 2 percent of the total milk supplied by all the producers sampled, was determined through a sequential process beginning with the first coefficient step in the premium schedule. The coefficient of variation having the lowest numerical value was selected and the total annual production of the producer to which that coefficient of variation corresponded, noted. The coefficient of variation having the second lowest numerical value was then selected and the total annual production of the producer to which the second coefficient of variation corresponded, added to the total annual production of the first producer selected. This procedure was done until 2 percent of the total annual milk production of all the producers sampled was reached. As the sum of the milk produced would ultimately exceed 2 percent when the last producer to be included in each step was added, the end range of each coefficient of variation step was derived through interpolation. That portion of the last producer's milk that exceeded the 2 percent level for the coefficient of variation step was then incorporated and used in calculating the coefficient of variation range for the subsequent 2 percent level or coefficient of variation step. This process was continued until the coefficient of variation range for all fifty steps was determined. This was done for each year.

the size of producers' dairy operations and producers' coefficient of variation would suggest that smaller dairy operations contribute more heavily to milk market imbalance than larger dairy operations.

Limitations

The range of the coefficients of variation in the total as well as in each step of this study may differ from that expected for the province, due to the exclusion of processors located in the Calgary region. However, this would not alter the outcome of the study as all the producers' coefficients of variation would be distributed over fifty steps, each representing 2 percent of the total industrial milk production.

CHAPTER V

EVALUATION OF SEASONAL SUBSIDY RATES

Identification of Seasonally Variable Costs

The focus of this thesis is to ascertain differential subsidy rates that reflect winter and summer production cost differences and to determine the feasibility of their implementation. To do this it was first necessary to identify those costs that vary seasonally and those that do not. Costs that are not expected to vary seasonally are interest payments,[1] taxes,[2] and depreciation. These costs are either long term or annual occurrences and should remain unchanged regardless of the amount of milk produced each season. Although the analytical results indicated (Appendix C) that the total interest paid each season varied, this disparity can be attributed to the timing of payments rather than to a seasonal cost difference. Most of the interest due was on long term loans, not operating loans, therefore the interest should be considered a fixed cost having no affect on the decision concerning the volume of milk to produce each season. A comparison of fixed costs on a hundredweight basis (Appendix C) showed that they varied seasonally. This was due to the fact that the divisor--total

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[1]This pertains only to interest payments on long term loans and not the interest payments on operating loans.

[2]In the computer format, taxes have been categorized under cash overhead costs together with utility expenses, which are seasonally variable. As the tax portion could not be separated from the utilities portion and the utility expenses exceeded taxes, the cash overhead costs were deemed variable. Consequently, taxes bias the results to some degree.

seasonal milk production--used in calculating the average costs per hundredweight was larger in summer than in winter.

Often family labour is considered fixed to the farm, however, in this case the operator's labour and unpaid family labour were considered variable to the enterprise. Approximately 140 labour hours were spent per cow during the winter as opposed to 124 hours in the summer. Of the total labour hours spent in the winter, the operator and his family provided 118 hours while hired labour[1] spent 22 hours. In the summer the operator and his family contributed 94 hours and hired labour 30 hours. Although the total hours expended per cow in each season differed by 16 hours, the operator's and his family's time decreased by 24 hours. The 8 hour split was made up by hired labour. The fact that hired labour increased by 8 hours during the summer to release 8 hours of the operator's and his family's time to other activities is supportive of the view that operator, family and hired labour are seasonally variable to the dairy enterprise.

Both the marketing and transportation costs and the miscellaneous costs varied seasonally on a total enterprise basis but were equal on an average cost or per hundredweight basis. This occurrence is due to the fact that both the marketing and transportation rates are constant for each hundredweight of milk shipped throughout the year. Although these costs are variable costs of milk production, they are not seasonally variable. Consequently, these costs have been categorized as variable costs of production and have been separated from those costs judged as seasonal variable costs.

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[1]Hired labour includes paid family labour.

The remaining costs listed in Table 5.1 and 5.2 vary seasonally on a per hundredweight produced basis. It is on a hundredweight basis that the balance of the analysis will be based as 1) the degree of cost variation is not as discernible on a total enterprise basis as on a per hundredweight basis. On a total enterprise basis, both the quantity produced and the costs vary between seasons whereas on a per hundredweight produced basis only the costs vary and the quantity of milk in question is kept constant at 100 lbs., and 2) it is on a hundredweight basis that subsidy payments and the price of milk are based.

Feed costs were the largest single input category responsible for cost differences between winter and summer milk production. From Tables 5.1 and 5.2 a spread of $1.67/cwt of milk produced can be observed. The shift to summer pasture use resulted in a $1.14 drop in total roughage costs per hundredweight of milk produced due to the decreased use of hay and silage. Also, the grain requirements increased by 11 tons in the winter but the volume of milk produced per milking cow[1] decreased resulting in an increase in grain costs per hundredweight of milk produced. Winter supplement expenses also increased due to an increased use of grain. Supplement and grain as inputs are complementary to each other as both are required to provide a balanced ration.

Bedding, breeding, medicine, veterinary, cash overhead costs and building and machinery costs accounted for a seasonal cost difference of $0.54/cwt of milk produced. Approximately 60 percent of

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[1]Milk production per milking cow dropped from 7,349.83 lbs. during the summer to 6,763.54 lbs. during the winter.

Table 5.1--Summary of Dairy Enterprise Costs During Summer, 1977.

		Total Enterprise	Per cwt Produced
Seasonal Variable Costs			
grain	44.00 tons	2,974.60	0.93
complete feed	17.39 tons	2,168.19	0.68
supplement	5.78 tons	1,337.27	0.42
salt, minerals, vitamins	8.21 cwt	62.66	0.02
roughage (silage, hay, etc.)	101.02 tons	4,477.01	1.41
pasture	183.10 amu.	1,377.30	0.43
processing costs		104.02	0.03
total feed costs		12,501.04	3.92
hired labour	764.40 hours	1,622.99	0.51
operator & family labour	1,406.00 hours	5,226.09	1.64
bedding & supplies		537.07	0.17
vet., medicine & breeding		471.40	0.15
cash overhead (utilities, taxes, etc.)		1,169.78	0.37
building & machinery operating costs		2,490.60	0.78
total variable costs (summer)		24,018.97	7.54
Variable Costs to Production			
marketing & transportation		5,296.45	1.66
miscellaneous		222.18	0.07
Fixed Costs			
depreciation		1,605.31	0.50
interest paid		767.64	0.24
interest on equity		3,155.06	0.99
Total Enterprise Costs		35,066.21	11.01

Source: Summarized by author.

Table 5.2--Summary of Dairy Enterprise Costs During Winter, 1977.

		Total Enterprise	Per cwt Produced
Seasonal Variable Costs			
grain	55.06 tons	3,466.85	1.26
complete feed	17.42 tons	1,954.33	0.71
supplement	6.69 tons	1,538.40	0.56
salt, minerals, vitamins	12.40 cwt	106.71	0.04
roughage (silage, hay, etc.)	175.80 tons	8,051.18	2.93
pasture	18.10 amu.	134.00	0.05
processing costs		99.48	0.04
total feed costs		15,350.93	5.59
hired labour	679.24 hours	1,207.14	0.44
operator & family labour	1,753.23 hours	6,545.94	2.38
bedding & supplies		1,333.38	0.49
vet., medicine & breeding		573.78	0.58
cash overhead (utilities, taxes, etc.)		1,579.95	0.58
building & machinery operating costs		1,991.13	0.73
total variable costs (winter)		28,582.25	10.42
Variable Costs to Production			
marketing & transportation		4,551.43	1.66
miscellaneous		186.10	0.07
Fixed Costs			
depreciation		1,605.31	0.58
interest paid		950.31	0.35
interest on equity		3,155.66	1.15
Total Enterprise Costs		30,031.06	14.23

Source: Summarized by author.

this cost spread is due to the practice of providing cows with straw bedding in the winter. Increased heat and light requirements were largely responsible for higher winter cash overhead costs. The $0.05 increase in summer building and machinery costs over winter are cancelled by the $0.06 decrease in summer veterinary and medicine costs.

The total sum of those average costs that vary seasonally was $7.54/cwt for summer milk and $10.42/cwt for winter milk, a difference of $2.88/cwt. These figures are relevant to the subsequent section which evaluates the effectiveness of seasonal subsidy rates.

Evaluation of the Effectiveness of Seasonal Subsidy Rates

Seasonality and its attendant problems may remain unless dairy producers are given some monetary incentive to alter their present pattern of milk production. If seasonal subsidy rates are to be successful in encouraging producers to reduce seasonality, the application of seasonal subsidy rates must provide the required monetary incentives. To determine the likelihood of production adjustments under seasonal subsidy rates, the change in producers' net returns[1]

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[1] For the purpose of this study, net return is defined as the difference between revenue earned from the sale of milk and seasonal variable costs. Revenue earned encompasses milk sales to plants and subsidy receipts. Other milk sales and milk used for farm purposes have been excluded as revenue earnings, as the volume sold or used seasonally is relatively constant and will not affect producers' net returns under seasonal subsidy rates. In calculating producers' net returns, the total costs of production and the variable costs of production were not used but rather the seasonal variable costs of production (Tables 5.1 and 5.2). Only those costs whose level varies seasonally should be considered as it is only these costs that will affect net returns when production adjustments are made.

resulting from 1) the transition from a constant annual subsidy rate to a seasonal subsidy rate and 2) from production adjustments must be ascertained. It is assumed that producers would only make production adjustments if there was economic justification for doing so.

To determine changes in producers' net returns resulting from production adjustments, it is first necessary to identify how the production adjustments are to be made and to ascertain the costs associated with these adjustments. It is difficult to assess these costs as the manner in which each producer makes the adjustments will affect the cost. For instance, heavier feeding or a revision in the breeding cycle are alternatives the producer might consider in attempting to obtain uniform milk production.

The costs illustrated in Tables 5.1 and 5.2 are average variable (seasonal) costs representative of the sample producers' production patterns. These costs do not necessarily reflect the cost of producing an additional hundredweight of milk in winter. It may well be that the marginal cost of producing an additional hundredweight of milk in winter is less than the $10.42/cwt cost indicated in Table 5.2, particularly if heavier winter feeding is adopted. On the other hand, if a revision in the breeding cycle is required, the costs involved in making the revision and in producing that additional milk must be considered. Since data concerning the cost of production adjustments or the production costs of various production patterns were nonexistent, the seasonal variable costs per hundredweight of milk produced estimated in the study were used to calculate sample producers' net returns under various production patterns.

Apart from the direct effect of a subsidy change on producers' returns, the policies and conditions stipulated in applying seasonal subsidy payments also have a direct effect on returns. Both the policy options and conditions chosen can affect the subsidy payments producers receive within each season. Several methods of subsidy payments based on the implementation of two opposing policy options have been developed and are presented to illustrate the effects of both the policy options and conditions and subsidy rates on producer returns under various production patterns. Common to the methods discussed is the condition that 50 percent of each producer's M.S.Q. sets the upper limit against which winter subsidy payments can be made. This condition is introduced to prevent a seasonal pattern reversal.

1. Evaluation of the Effects of Seasonal Subsidy Rates on Producers' Returns Under Policy Option One

> The C.D.C. budget allowance for subsidy payments would not be extended beyond the current level of $2.66/cwt for in-quota milk.[1]

As a consequence of this policy, producers' total subsidy receipts under seasonal subsidy rates could not exceed the monies producers received for in-quota milk at the annual rate of $2.66/cwt. Given this policy option, the following formula was employed to compute a summer and winter subsidy rate that would conform to the policy.

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[1] This policy has been posited in light of the government's attempt to reduce government expenditures.

$$\$2.66/\text{cwt} = .5\,X_s + .5(X_s + Y)$$

where: X_s = summer subsidy rate per hundredweight,

Y = difference in summer and winter variable costs per hundredweight,

$X_s + Y$ = winter subsidy rate per hundredweight.

As illustrated in Tables 5.1 and 5.2, a summer and winter cost split of \$2.88/cwt (Y) was determined. Thus, the winter and summer subsidy rate as calculated through the formula is \$4.10/cwt and \$1.22/cwt, respectively. Transformed to a butterfat basis,[1] the summer and winter subsidy rates are \$1.17/lb. and \$0.35/lb. Employing these subsidy rates, two methods of subsidy payments have been derived. Each method is dependent on the subsidy payment conditions imposed.

1.1 Method One

Condition: Within each season, subsidy payments are to be restricted to 50 percent of a producer's annual M.S.Q.

As the average annual M.S.Q. for the sample producers was 19,125.50 lbs., subsidy payments would be restricted to 9,562.75 lbs. butterfat each season under the aforementioned condition. Given the assumption that the sample producers' subsidy payments would be restricted to a maximum of 9,562.75 lbs. per season and the cost of production data collected in the study, the sample producers' expected net returns under various

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[1] This assumes a 3.5 percent level of butterfat per hundredweight of milk.

sales patterns[1] were forecast (Table 5.3). Each scenario listed in the table represents a sales pattern. An explanation of each scenario appears in Figure 5.1.

Scenarios 1 and 2 illustrate expected net returns for the sales pattern observed in the study under both the current subsidy rate and the proposed subsidy rates. Producers' net returns computed in scenario 2 did not vary from those calculated in scenario 1 because 1) the sales pattern was not varied, and 2) over 50 percent of the allotted M.S.Q. was produced each season, allowing producers to reap full subsidy payments.

Scenario 3, representing equal summer and winter sales, indicates that producer returns would diminish by $607.02. Summer production was projected to decline by 220.28 cwt, resulting in a $273.15 loss in returns during the summer. In winter, producers would incur an additional loss of $333.86 due to the increased cost of producing 220.11 cwt more milk.[2]

Under scenario 4, the loss in net returns further increased. This again can be attributed to the reduced summer sales and increased winter sales. In scenario 5, producers were able to reduce losses by adjusting production so that all that is sold each season is subsidized.

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[1]The variation between production and sales volume each season is approximately 138 cwt. As this variation was found to be relatively constant between seasons, the following discussion will be in terms of producers' sales to processing plants and not in terms of production.

[2]During winter, producers incur a loss for each hundredweight of milk produced as milk is sold for $8.90/cwt but costs $10.42/cwt to produce. Therefore, increased winter production increases their losses. On the other hand, a decline in summer production and sales results in a loss of revenue as summer milk is sold for $8.78/cwt but is produced for $7.54/cwt.

Figure 5.1--Explanation of Scenarios Used in Tables 5.3-5.6.

Scenario 1

Milk Sales:[1]	Total annual sales level maintained at 5,630.17 cwt as found in the study. Summer sales: 3,035.28 cwt; Winter sales: 2,594.89 cwt.
Butterfat Sales:	As found in the study; Summer sales: 10,714.54 lbs; Winter sales: 9,756.79 lbs.
Market Share Quota:	The average market share quota for producers sampled was 19,125.50 lbs. For all the conditions listed 19,125.50 lbs of butterfat set the upper limit on which producers could receive subsidy payments.

Scenario 2

The exact replicate of Scenario 1 with the exception of the subsidy rates. Seasonal subsidy rates have been introduced.

Scenario 3

Milk Sales:	Total annual sales level maintained at 5,630.17 cwt as found in the study. The sales pattern, however, was adjusted so that equal volumes of milk were sold each season. Summer sales: 2,815.09 cwt; Winter sales: 2,815.09 cwt.
Butterfat Sales:	Butterfat sales based on a 3.53 percent level of butterfat for summer milk and a 3.76 percent level of fat for winter milk. Summer sales: 9,936.95 lbs; Winter sales: 10,584.40 lbs.

Scenario 4

Milk Sales:	Total annual sales level maintained at 5,630.17 cwt as found in the study. The sales pattern, however, was adjusted to ensure that only 50 percent of producers' allowable market share quota was subsidized during the summer. Summer sales: 2,708.99 cwt; Winter sales: 2,921.18 cwt.
Butterfat Sales:	Based on 3.53 and 3.76 percent level of butterfat per cwt. Summer sales: 9,562.75 lbs; Winter sales: 10,982.96 lbs.

Scenario 5

Milk Sales:	Total annual volume of milk production reduced to 5,252.27 cwt. The sales pattern was adjusted so that uniform butterfat sales were ensured. Summer sales: 2,708.99 cwt; Winter sales: 2,543.28 cwt.
Butterfat Sales:	Based on a 3.53 and 3.76 percent level of butterfat per cwt. Uniform butterfat sales achieved. Summer sales: 9,562.75 lbs; Winter sales: 9,562.75 lbs.

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[1]Milk sales denoted here do not include private milk sales between the producer and the public. These milk sales were found to be relatively constant between seasons at 12 to 13 cwt.

Table 5.3--Expected Producer Returns for Scenarios 1-5 Under Method One, 54-46 Percent Seasonality.

	Summer				Winter					Annual	
Subsidy Rate: S[1]	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Summer Net Returns	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Winter Net Returns	Subsidy Payment Loss[2]	Annual Net Returns	Reduction in Returns
2.66/cwt 0.76/1b	$ 26649.76 (3035.28) cwt	$ 8143.05 (10714.54) lbs	$ 22886.01 (3035.28) cwt	$ 11906.80							
1											
2.66/cwt 0.76/1b					$ 23094.52 (2594.89) cwt	$ 6392.33 (8410.96) lbs	$ 27038.75 (2594.89) cwt	$ 2448.10	$ ------	$ 14354.90	$ ----
1.22/cwt 0.35/1b	26649.76 (3035.28)	3346.96 (9562.75)	22886.01 (3035.28)	7110.71							
2											
4.10/cwt 1.17/1b					23094.52 (2594.89)	11188.42 (9562.75)	27038.75 (2594.89)	7244.19	0.00	14354.90	0.00
1.22/cwt 0.35/1b	24716.49 (2815.09)	3346.96 (9562.75)	21225.78 (2815.09)	6837.67							
3											
4.10/cwt 1.17/1b					25054.30 (2815.09)	11188.42 (9562.75)	29333.24 (2815.09)	6909.48	0.00	13747.15	607.75
1.22/cwt 0.35/1b	23784.93 (2708.99)	3346.96 (9562.75)	20425.78 (2708.99)	6706.11							
4											
4.10/cwt 1.17/1b					25998.50 (2921.18)	11188.42 (9562.75)	30438.70 (2921.18)	6748.22	0.00	13454.33	900.57
1.22/cwt 0.35/1b	23784.93 (2708.99)	3346.96 (9562.75)	20425.78 (2708.99)	6706.11							
5											
4.10/cwt 1.17/1b					22635.23 (2543.28)	11188.42 (9562.75)	26500.98 (2543.28)	7322.67	0.00	14028.78	326.12

[1]S = Scenario

[2]Subsidy payments in Scenarios 2 to 5 are subtracted from the subsidy payment of $14535.38 projected in Scenario 1.

Source: Summarized by author.

This could be accomplished if producers decreased winter production to a level that equated the butterfat produced to 50 percent of their M.S.Q.

It would seem that under the policy and condition set out in Method One, seasonal subsidy rates are ineffective in reducing seasonality. According to scenario 2, producers would be no worse off under seasonal subsidy rates if they maintained their current sales pattern. However, the results obtained may be a direct result of the level of seasonality. A 54-46 split between summer and winter production was found to be representative of the producers sampled. To determine whether the results obtained are a direct result of the level of seasonality, producer returns under a 65-35 percent split in sales were calculated (Table 5.4).

As indicated in scenario 1, producers would be subsidized to the full extent of their summer sales but only on a portion of their winter sales as their total sales exceeded their annual M.S.Q. However, a comparison of scenarios 1 and 2 indicates that producer returns could decrease by $2,510.53 from a subsidy change. This loss can be attributed to the level of butterfat sales in winter and the limitation concerning maximum allowable M.S.Q. eligible for summer subsidy. Under this method, producers would receive the high winter subsidy rate on only 7,409.31 lbs. rather than on 9,562.75 lbs. of eligible M.S.Q. This loss in net returns could be reduced if winter sales were to increase as seen in scenario 3 in Table 5.3. It therefore appears that this method of subsidy payment discriminates against producers with high levels of seasonality, as there are gains to be made in producer returns by adjusting to a sales pattern of equal winter and summer sales. Conversely, for producers with low levels of seasonality,

Table 5.4--Expected Producer Returns for Scenarios 1-2 Under Method One, 65-35 Percent Seasonality.

		Summer				Winter				Annual	
Subsidy Rate: S		Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Summer Net Returns	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Winter Net Returns	Subsidy Payment Loss	Annual Net Returns	Reduction in Returns
2.66/cwt 0.76/lb	1	$ 32131.38 (3659.61) cwt[1]	$ 9318.00 (12918.42) lbs	$ 27593.46 (3659.61) cwt	$ 14355.92							
2.66/cwt 0.76/lb						$ 17537.98 (1970.56) cwt[2]	$ 4717.38 (6207.08) lbs	$ 20533.23 (1970.56) cwt	$ 1722.13	$ ------	$ 16078.05	$ -----
1.22/cwt 0.35/lb	2	32131.38 (3659.61)	3346.96 (9562.75)	27593.46 (3659.61)	7884.88							
4.10/cwt 1.17/lb						17537.98 (1970.56)	8668.88 (7409.31)	20533.23 (1970.56)	5673.63	2519.54	13558.51	2619.54

[1] 3659.61 cwt of milk produced in summer yields 12,918.42 lbs. of butterfat.

[2] 1970.56 cwt of milk produced in winter yields 7409.31 lbs. of butterfat.

Source: Summarized by author.

losses would be incurred by equating winter and summer sales (scenarios 2 and 3, Table 5.3).

1.2 Method Two

Condition: All summer sales are to be subsidized at a rate of $1.22/cwt and the balance of M.S.Q. subsidized during the winter at a rate of $4.10/cwt.

As in Method One, comparisons between scenarios were based on the average production costs, M.S.Q. and the production level of producers sampled in the study. Table 5.5 lists the results of the comparisons.

Due to the condition incorporated in this method, producers could lose $944.48 under the proposed subsidy rates (scenario 2) if they were to maintain their current production and sales level. This would be the result of reduced total subsidy payments. Producers would receive the low summer subsidy rate on 56 percent of their M.S.Q. rather than on 50 percent as in Method One. Only 8,410.96 lbs., 46 percent of M.S.Q. would be subsidized out of the 9,756.79 lbs. sold.

When production was adjusted so that equal volumes of milk could be sold each season (scenario 3), producers' losses were found to decline marginally. Although producers might be able to recoup $637.39 in subsidy receipts under scenario 3, they incur revenue losses through decreased summer and increased winter sales.

In scenario 4, summer sales were further reduced so that only 50 percent of allowable M.S.Q. was subsidized. Again, losses can be attributed to the projected decrease in summer and increase in winter sales.

Table 5.5--Expected Producer Returns for Scenarios 1-5 Under Method Two.

		Summer				Winter					Annual	
Subsidy Rate	S	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Summer Net Returns	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Winter Net Returns	Subsidy Payment Loss	Annual Net Returns	Reduction in Returns
2.66/cwt 0.76/lb	1	$ 26649.76 (3035.28) cwt	$ 8143.05 (10714.54) lbs	$ 22886.01 (3035.28) cwt	$ 11906.80							
2.66/cwt 0.76/lb						$ 23094.52 (2594.89) cwt	$ 6392.33 (8410.96) lbs	$ 27038.75 (2594.89) cwt	$ 2448.10	$ ------	$ 14354.90	$ -----
1.22/cwt 0.35/lb	2	26649.76 (3035.28)	3750.09 (10714.54)	22886.01 (3035.28)	7513.84							
4.10/cwt 1.17/lb						23094.52 (2594.89)	9840.82 (8410.96)	27038.75 (2594.89)	5896.59	944.47	13410.43	944.47
1.22/cwt 0.35/lb	3	24716.49 (2815.09)	3477.93 (9936.95)	21225.78 (2815.09)	6968.64							
4.10/cwt 1.17/lb						25054.30 (2815.09)	10750.60 (9188.55)	29333.24 (2815.09)	6471.66	306.85	13440.30	914.60
1.22/cwt 0.35/lb	4	23784.93 (2708.99)	3346.96 (9562.75)	20425.78 (2708.99)	6706.11							
4.10/cwt 1.17/lb						25998.50 (2921.18)	11188.42 (9562.75)	30438.70 (2921.18)	6748.22	0.00	13454.33	900.57
1.22/cwt 0.35/lb	5	23784.93 (2708.99)	3346.96 (9562.75)	20425.78 (2708.99)	6706.11							
4.10/cwt 1.17/lb						22635.23 (2543.28)	11188.42 (9562.75)	26500.98 (2543.28)	7322.67	0.00	14028.78	326.12

Source: Summarized by author.

Only in scenario 5 are producers able to recover a substantial portion of their losses. They are able to do so by cutting back their winter production so that all milk sold is subsidized.

Although the results indicate that producers are able to recoup a substantial portion of their losses under the sales pattern suggested in scenario 5, it may be unreasonable to expect them to equalize summer and winter butterfat sales. To equalize butterfat sales, producers would be required to estimate their summer and winter average butterfat level. This would present difficulties as the butterfat content in milk is highly affected by the quality of pasture and feed which to some extent may be beyond the producer's control. A 0.1 percent deviation in actual butterfat levels from a producer's estimate could affect his returns substantially.

If it is unreasonable to expect producers to equalize summer and winter butterfat sales, the effectiveness of the two methods of subsidy payments must be evaluated on the basis of their ability to encourage an increase in winter sales. As observed in Table 5.3, producers' returns are reduced under Method One if they opt to increase winter sales. Consequently, this method would seem ineffective.

Under Method Two (Table 5.5), producers' returns do not decline but remain relatively constant (scenarios 2 and 3). Although producers' net returns would not decline, there is no assurance that producers would attempt the adjustment. Costs may be involved in initiating production adjustments that were not considered in the computation of seasonal subsidies. The costs involved in making the production adjustments are difficult to estimate as each producer will differ in the method he uses to make the adjustment. Only the producer will be able

to accurately assess the costs involved and judge whether production adjustments are worthwhile.

Apart from the financial aspects of adjusting one's production and sales pattern, nonfinancial considerations may be of utmost importance. To even out the flow of industrial milk between seasons, closer management supervision is required. A cow's lactation length becomes critical as does her breeding. Delayed breeding through mismanagement would alter the production pattern. If a producer does not have the required skills, he will have to spend time developing them. Calculating the necessary changes he must make in his herd will also require his time. The extra hours a producer may have to spend making the adjustment and maintaining the pattern may not be worthwhile to him. Although this is not a financial consideration, it is an economic one in that his leisure time has a value which he may not be willing to trade off without a greater amount of financial gain.

1.3 A Winter Subsidy Program

To increase monetary incentives for production adjustments, the split between summer and winter subsidies could be widened. However, if winter subsidy rates were to be increased, summer subsidies would have to be decreased if the C.D.C. is to stay within its budget for subsidy allotment. Therefore, a winter subsidy program was examined where that M.S.Q. remaining in winter was subsidized at a rate of \$5.32/cwt. This program took an extreme position regarding subsidy rates as the winter subsidy rate was doubled and summer subsidy payments were discontinued.

Under the sales pattern observed in the study, the introduction

of the outlined winter subsidy program would result in a large decrease in producer returns (scenarios 1 and 2, Table 5.6). Producers returns could diminish by $1,750.73. However, if producers were to equalize summer and winter sales, they could regain $575.00 in returns (scenario 3).

Whether or not a producer strives to supply equal volumes of summer and winter milk depends on his financial and nonfinancial considerations. However, of the subsidy rates and methods discussed, a winter subsidy program is likely to be the most effective due to the severity of producer losses. In this case, the benefits (i.e., the possibility of regaining $575.00 in returns) may outweigh all financial and nonfinancial considerations.

One of the problems arising from the methods of subsidy payments proposed under Policy Option One is that producer returns are reduced. One of the C.D.C.'s objectives is to provide producers with a "fair return" on their investment. It is through the C.D.C.'s offer-to-purchase program and subsidy payments that producers are ensured of a return considered to be "fair" on their investment. The seasonal subsidy rates suggested partially defeat the purpose of subsidy payments. It is because of this drawback that the second policy option is presented.

2. Evaluation of the Effects of Seasonal Subsidy Rates on Producers' Returns Under Policy Option Two

The C.D.C. budget allowance for subsidy payments could be extended beyond the current level of $2.66/cwt for in-quota milk should the need arise.

Table 5.6--Expected Producer Returns for Scenarios 1-3 Under a Winter Subsidy Program.

	Summer				Winter					Annual	
Subsidy Rate: S	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Summer Net Returns	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Winter Net Returns	Subsidy Payment Loss	Annual Net Returns	Reduction in Returns
1: 2.66/cwt 0.76/lb	$ 26649.76 (3035.28) cwt	$ 8143.05 (10714.54) lbs	$ 22886.01 (3035.28) cwt	$ 11906.80							
2.66/cwt 0.76/lb					$ 23094.52 (2594.89) cwt	$ 6392.33 (8410.96) lbs	$ 27038.75 (2594.89) cwt	$ 2448.10	$ ------	$ 14354.90	$ -----
2: 0.00/cwt 0.00/lb	26649.76 (3035.28)	0.00 (0.00)	22886.01 (3035.28)	3763.75							
5.32/cwt 1.52/lb					23094.52 (2594.89)	12784.66 (8410.96)	27038.75 (2594.89)	8840.43	1750.00	12604.18	1750.72
3: 0.00/cwt 0.00/lb	24716.49 (2815.09)	0.00 (0.00)	21225.78 (2815.09)	3490.71							
5.32/cwt 1.52/lb					25054.30 (2815.09)	13966.60 (9188.55)	29333.24 (2815.09)	9687.66	568.78	13178.37	1176.53

Source: Summarized by author.

If the C.D.C.'s objectives are to maintain producer returns at their current level and to encourage a more balanced supply of milk, the previously proposed subsidy rates are unsuitable. Neither method was able to meet both objectives. It would be oversimplifying matters to suggest that the C.D.C. provide an additional $2.88/cwt,[1] over the current subsidy of $2.66/cwt, for each producer's incremental increases in winter milk sales. Such an approach is not likely to encourage an increase in winter sales as producers would be no better off if they adjusted their production pattern. A winter subsidy increase of $2.88/cwt would only cover the increased cost of producing winter milk. Consequently, producer returns would remain at the same level. In short, this approach offers no additional monetary incentive.

It would appear that if the C.D.C. were to achieve both objectives, a subsidy payment program would have to be devised that allowed producers to retain their current level of net returns only if the supply of milk between seasons were equalized. Although producers may initially incur losses under their present seasonal production pattern, they would be able to recoup these losses under a pattern of equal winter and summer milk sales. Given the C.D.C.'s stated objectives, however, it is impossible to determine a summer and winter subsidy rate that could be applied to all producers. To fulfill these objectives, different seasonal subsidy rates would have to be computed for each producer and this is impractical.

Alternatively, the C.D.C. could achieve its objectives if it

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[1]For the sample producers, the cost of producing winter milk exceeded that of summer milk by $2.88/cwt.

implemented the seasonal subsidy program introduced in Method Two and adopted an additional lump sum payment to compensate only those producers who equalized summer and winter milk sales for their loss in revenue. For instance, looking back at scenario 3 in Table 5.5, it is shown that a producer's returns could diminish by \$914.80. The following formula could be used to calculate the lump sum payment on a hundredweight basis.

$$\text{Lump Sum Payment} = \underbrace{(M_s(P_s - F_s))}_{1} + \underbrace{(M_w(P_w - F_w))}_{2} + \underbrace{[\$0.76\text{M.S.Q.} - F_sB_sS - ((\text{M.S.Q.} - F_sB_s)W]}_{3}$$

where: M_s = returns net of summer variable costs per hundredweight,

P_s = hundredweight of summer sales prior to uniform sales,

F_s = hundredweight of summer sales under uniform sales supply,

M_w = returns net of winter variable costs per hundredweight,

P_w = hundredweight of winter sales prior to uniform sales,

F_w = hundredweight of winter sales under uniform sales supply,

M.S.Q. = market share quota, pounds of butterfat,

B_s = average butterfat per hundredweight of summer milk,

B_w = average butterfat per hundredweight of winter milk,

S = summer subsidy on a butterfat basis (i.e., \$0.35),

W = winter subsidy on a butterfat basis (i.e., \$1.17).

Section 1 of the equation considers revenue losses due to decreased summer sales whereas section 2 considers losses in revenue resulting from increased winter sales. In the study, the summer and winter returns over variable costs, M_s and M_w, were computed to be \$1.24/cwt and -\$1.52/cwt. Section 3 is a correction factor for subsidy

losses. As observed in scenario 3, summer butterfat sales exceeded winter butterfat sales. Because production is not equated on a butterfat basis and subsidies are made on all summer butterfat sales (Method Two), producers would not be able to receive their full subsidy entitlement as over 50 percent of the allowable M.S.Q. would be subsidized at the low summer rate of $1.22/cwt. This section of the lump sum payment formula allows subsidy losses to be compensated by computing the difference in producer subsidy receipts under a subsidy rate of $2.66/cwt or $0.76/lb. versus that under seasonal subsidy rates.

The feasibility of implementing a lump sum approach, however, is questionnable as 1) it would discriminate against producers who currently supply relatively equal volumes of summer and winter milk and 2) it would effectively be rewarding once highly seasonal producers for their former high levels of seasonality. A comparison of scenarios 1 in Tables 5.3 and 5.4 reveals that the estimated returns, of producers with a 65-35 percent level of seasonality, are greater than producers with 54 and 46 percent seasonality. Consequently, as a result of the inclusion of Sections 1 and 2 in the lump sum formula, those producers with high levels of seasonality would receive greater returns upon the implementation of a lump sum approach once they equalized summer and winter milk sales.

The Effect of a Change in the Dairy Year

It should be noted that the effects of the proposed methods of subsidy payments on producer returns are based on the assumption that producers' M.S.Q. are issued in April. Until 1978, M.S.Q. was issued in April, the beginning of the dairy year. In April 1978, the Minister of Agriculture, Eugene Whelan, announced that the dairy year would be

changed to begin in August starting August 1, 1979. This change was introduced in an effort to attain a more uniform milk production pattern. The logic behind this is based on the fact that producers tend to cut back production as they approach the end of the dairy year in order to stay within the limits of their M.S.Q. With the dairy year beginning in August, producers may now have to reduce their milk shipments at a time when milk production is usually at a peak. This may negate the necessity of a seasonal subsidy program.

Assuming that changing the dairy year would not reduce seasonality, methods of subsidy payments based on the dairy year beginning in August were studied. Although the altered dairy year would not affect the results in Method One of subsidy payments, the conditions stipulated in Method Two had to be revised. This was necessary as this method required that the level of summer sales be known before winter subsidies were paid. It would be difficult to implement the subsidy suggested in Method Two if the dairy year began in August as producers' summer sales for the following year are unknown. Method Two was revised so that all winter sales were subsidized and the balance of M.S.Q. remaining was subsidized during the summer at a lower rate. The effect of this approach on producer returns is indicated in Table 5.7. Under the proposed subsidy rates of $1.22/cwt and $4.10/cwt for summer and winter milk, respectively, producer returns would increase by $159.11 (scenario 2). This increase can be attributed to an increase in subsidy payments. By adjusting to the sales pattern indicated in scenario 3, producer returns increase nominally. Although producers would be compensated for the increased cost of winter production, the costs involved in making the adjustments are not accounted for. Consequently, seasonal

Table 5.7--Expected Producer Returns for Scenarios 1-3 Under Revised Method Two, Dairy Year Beginning in August.

	Summer				Winter					Annual	
Subsidy Rate: S	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Summer Net Returns	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Winter Net Returns	Subsidy Payment Loss	Annual Net Returns	Reduction in Returns
2.66/cwt 0.76/lb	$ 26649.76 (3035.28) cwt	$ 8143.05 (10714.54) lbs	$ 22886.01 (3035.28) cwt	$ 11906.80							
1											
2.66/cwt 0.76/lb					$ 23094.52 (2594.89) cwt	$ 6392.33 (8410.96) lbs	$ 27038.75 (2594.89) cwt	$ 2448.10	$ ------	$ 14354.90	$ -----
1.22/cwt 0.35/lb	26649.76 (3035.28)	3279.05 (9368.71)	22886.01 (3035.28)	7042.80							
2											
4.10/cwt 1.17/lb					23094.52 (2594.89)	11415.44 (9756.79)	27038.75 (2594.89)	7471.21	-159.11[1]	14514.01	-159.11
1.22/cwt 0.35/lb	24716.49 (2815.09)	2989.38 (8541.10)	21225.78 (2815.09)	6480.09							
3											
4.10/cwt 1.17/lb					25054.30 (2815.09)	12383.75 (10584.80)	29333.24 (2815.09)	8104.81	-837.75	14584.90	-230.00

[1]A negative sign denotes an increase in subsidy payments.

Source: Summarized by author.

subsidy payments on all winter sales and the balance of summer sales may be ineffective.

To determine whether these results are a direct consequence of the level of seasonality, producer returns when a 65-35 percent split in production occurred were calculated (Table 5.8). Subtracting producer returns calculated in scenario 2 from those in scenario 3, it can be observed that producer returns could increase by $272.68 if they were to supply equal volumes of milk each season. Depending on the adjustments needed to change their sales patterns, this approach might be successful in encouraging producers with higher levels of seasonality to increase winter sales.

Alternatively, an approach where winter subsidy payments of $5.32/cwt are made on all winter milk sales and subsidization of summer milk sales discontinued could be used. In Table 5.9, it can be observed that producer returns could increase by $294.94. Producer returns could be further increased by $650.22 if winter and summer supplies of milk were equated (scenario 3). This increase in returns is due to the increase in subsidy payments. It should be noted that under such remunerative subsidy payments, some producers may increase winter production to the point that a reversal in seasonality occurs. Therefore, restrictions concerning the level of winter sales may be required to avoid the possibility of reversed seasonality. For instance, winter sales on a hundredweight basis could be restricted to 50 percent of annual sales. This restriction, however, does not require the producer to restrict winter sales to 50 percent of his M.S.Q. As seen in scenario 3, winter butterfat sales exceeded 50 percent of M.S.Q. (19,125.50 lbs.). This is a direct result of the fact that the butter-

Table 5.8--Expected Producer Returns for Scenarios 1-3 Under Revised Method Two, 65-35 Percent Seasonality, Dairy Year Beginning in August.

	Summer				Winter					Annual	
Subsidy Rate: S	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Summer Net Returns	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Winter Net Returns	Subsidy Payment Loss	Annual Net Returns	Reduction in Returns
2.66/cwt 0.76/lb	$ 32131.38 (3659.61) cwt	$ 9818.00 (12918.42) lbs	$ 27593.46 (3659.61) cwt	$ 14355.92							
1											
2.66/cwt 0.76/lb					$ 17537.98 (1970.56) cwt	$ 4717.38 (6207.08) lbs	$ 20533.23 (1970.56) cwt	$ 1722.13	$ ------	$ 16078.05	$ -----
1.22/cwt 0.35/lb	32131.38 (3659.61)	4100.67 (11716.19)	27593.46 (3659.61)	8638.59							
2											
4.10/cwt 1.17/lb					17537.98 (1970.56)	8668.88 (7409.31)	20533.23 (1970.56)	5673.63	1765.83	14312.22	1765.83
1.22/cwt 0.35/lb	24716.49 (2815.09)	2989.38 (8541.10)	21225.78 (2815.09)	6480.09							
3											
4.10/cwt 1.17/lb					25054.30 (2815.09)	12383.75 (10584.40)	29333.24 (2815.09)	8104.81	-837.75	14584.90	-1493.15

Source: Summarized by author.

Table 5.9--Expected Producer Returns for Scenarios 1-3 Under a Winter Subsidy Program, Dairy Year Beginning in August.

		Summer				Winter					Annual	
Subsidy Rate:	S	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Summer Net Returns	Milk Sales to Plant	Subsidy Receipts	V.C. of Production	Winter Net Returns	Subsidy Payment Loss	Annual Net Returns	Reduction in Returns
2.66/cwt 0.76/1b	1	$ 26649.76 (3035.28) cwt	$ 8143.05 (10714.54) lbs	$ 22886.01 (3035.28) cwt	$ 11906.80							
2.66/cwt 0.76/1b						$ 23094.52 (2594.89) cwt	$ 6392.33 (8410.96) lbs	$ 27038.75 (2594.89) cwt	$ 2448.10	$ ------	$ 14354.90	$ -----
0.00/cwt 0.00/1b	2	26649.76 (3035.28)	0.00 (0.00)	22886.01 (3035.28)	3763.75							
5.32/cwt 1.52/1b						23094.52 (2594.89)	14830.32 (9756.79)	27038.75 (2594.89)	10886.09	-344.94	14649.84	-294.94
0.00/cwt 0.00/1b	3	24716.49 (2815.09)	0.00 (0.00)	21225.78 (2815.09)	3490.71							
5.32/cwt 1.52/1b						25054.30 (2815.09)	16088.29 (10584.40)	29333.24 (2815.09)	11809.35	-1552.91	15300.06	-945.16

Source: Summarized by author.

fat level in winter milk exceeded the 3.5 butterfat test level. Although this approach requires that the budget allowance for subsidies be extended, the increase may be large enough to induce producers to reduce seasonality.

CHAPTER VI

EVALUATION OF A SEASONAL PRICING PLAN AS FORMULATED BY RUSSELL

Analysis of the Coefficients of Variation Derived for Sample Producers

To identify some of the possible problems associated with the seasonal pricing plan proposed by Russell and to evaluate the feasibility of its implementation in Alberta, coefficients of variation were calculated for sample industrial milk producers in the province. A producer's annual coefficient of variation, reflecting his contribution to milk market imbalance, was calculated on the basis of his monthly milk shipments and his M.S.Q. Only 283 (1976) and 272 (1977) of the 395 producer files collected were usable. The balance of the records were incomplete and therefore discarded to avoid biasing the results.[1]

Employing the remaining complete producer files, the coefficient of variation for each producer was calculated for 1976 and 1977. All coefficients of variation were then arranged in numeric order and divided into fifty consecutive steps, each representing 2 percent of the sample producers' total milk supply. The coefficient of variation steps, as well as the distribution of the sample producers over the fifty steps, are summarized in Tables 6.1 and 6.2 Table 3.4 in Chapter III illustrates the coefficients of variation for the New England milk producers sampled by Russell.

In Alberta, approximately 2 percent of the industrial milk was produced by producers having a coefficient of 9.4 (1976) and 10.3 (1977)

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[1]See Part II of Chapter IV for discussion.

Table 6.1--Coefficient of Variation Ranges Which Cover Two Percent of Sample Producers Total Milk, Alberta, 1976.

Coefficient of Variation Steps	Coefficient of Variation Range (Premium Range)	Number of Producers	Coefficient of Variation Steps	Coefficient of Variation Range (Deductions Range)	Number of Producers
25	21.347-21.776	8	26	21.777-22.050	3
24	20.922-21.346	6	27	22.051-22.457	5
23	20.757-20.921	3	28	22.458-22.733	7
22	20.638-20.756	4	29	22.739-23.131	4
21	19.974-20.637	6	30	23.132-23.460	7
20	19.254-19.973	6	31	23.461-23.805	6
19	18.803-19.253	5	32	23.806-24.700	9
18	18.197-18.802	6	33	24.701-26.231	9
17	17.934-18.196	6	34	26.232-27.689	8
16	17.295-17.933	6	35	27.690-28.144	7
15	16.896-17.294	5	36	28.145-28.890	7
14	16.609-16.895	3	37	28.891-29.547	4
13	16.058-16.608	6	38	29.548-30.754	7
12	15.832-16.057	6	39	30.755-31.889	6
11	15.074-15.831	7	40	31.890-32.474	5
10	13.933-15.073	7	41	32.475-33.506	7
9	13.256-13.932	3	42	33.507-34.126	7
8	13.064-13.255	3	43	34.127-34.402	4
7	12.693-13.063	4	44	34.403-34.831	4
6	11.744-12.692	5	45	34.832-35.292	5
5	11.147-11.743	5	46	35.293-36.226	6
4	10.814-11.146	3	47	36.227-38.551	7
3	10.156-10.813	4	48	38.552-40.867	8
2	9.182-10.155	5	49	40.868-46.443	8
1	Up to 9.181	4	50	Over 46.443	8
Total		127	Total		156

Source: Summarized by author from data collected.

Table 6.2--Coefficient of Variation Ranges Which Cover Two Percent of Sample Producers Total Milk, Alberta, 1977.

Coefficient of Variation Steps	Coefficient of Variation Range (Premium Range)	Number of Producers	Coefficient of Variation Steps	Coefficient of Variation Range (Deductions Range)	Number of Producers
25	25.056-26.409	7	26	26.410-26.665	5
24	24.938-25.155	4	27	26.666-27.385	5
23	24.451-24.939	5	28	27.386-28.052	5
22	23.871-24.450	6	29	28.053-28.663	4
21	23.285-23.870	6	30	28.664-29.103	4
20	23.092-23.284	5	31	29.104-29.271	5
19	22.852-23.091	4	32	29.272-30.040	6
18	22.476-22.851	4	33	30.041-30.577	5
17	22.215-22.475	3	34	30.578-30.966	5
16	21.720-22.214	6	35	30.967-31.653	7
15	20.455-21.719	8	36	31.654-32.545	7
14	19.770-20.454	6	37	32.546-32.740	5
13	19.342-19.769	7	38	32.741-33.390	6
12	18.656-19.341	5	39	33.391-33.502	1
11	18.527-18.655	4	40	33.503-35.336	8
10	17.800-18.526	5	41	35.337-36.077	7
9	17.232-17.799	4	42	36.078-36.638	6
8	16.497-17.231	7	43	36.639-37.206	6
7	16.448-16.496	2	44	37.207-38.608	7
6	14.842-16.447	5	45	38.609-40.577	7
5	14.622-14.841	5	46	40.578-42.527	7
4	13.044-14.621	5	47	42.528-43.895	7
3	12.538-13.043	3	48	43.896-46.605	7
2	10.467-12.537	6	49	46.606-55.386	8
1	Up to 10.466	5	50	Over 55.386	5
Total		127	Total		145

Source: Summarized by author from data collected.

or less. However, in Russell's study, 10 to 12 percent of New England's fluid milk supply (1961-1962) was provided by producers with coefficients of less than 9.4 and 10.3. In 1977, the lower range limit of the fiftieth coefficient of variation step for Alberta industrial milk producers, also exceeded the lower range limit of the fiftieth step calculated by Russell. Since 1) the numeric value of the coefficients of variation indicate the degree of imbalance in milk supply, and 2) the numeric value of the coefficients of variation for each coefficient of variation step tended to be lower for the New England producers than that of Alberta industrial producers, it would appear that Alberta experienced greater fluctuations in industrial milk supply than did New England in fluid milk supply. However, variables such as the date of each study, weather differences, dairy policies and the fact that one study pertained to fluid producers and the other to industrial producers, could explain why the coefficients of variation calculated for the Alberta industrial producers were higher.

To illustrate the distribution of the sample producers more clearly, Table 6.3 presents the distribution of producers according to coefficient of variation intervals of 10. Inspection of the table indicates a fairly normal distribution of producers' coefficients of variation over the coefficient intervals, with the peak in producer numbers over the coefficient interval 20-30. Because the distribution of producers' coefficients of variation approximates a normal distribution, the mean coefficient level approxiamtes the modal coefficient interval. Consequently, the mean coefficient of variation for 1976 and 1977 would be somewhere between 20 and 30.

Table 6.3--Distribution of Sample Industrial Producers' Coefficients of Variation Throughout the Total Coefficient Range, Categorized According to Coefficient Intervals, Alberta, 1976 and 1977.

Coefficient of Variation (C.V.) Interval	Number of C.V. Steps 1976	Number of Producers 1976	Number of C.V. Steps 1977	Number of Producers 1977
0-10	2	9	1	5
10-20	18	90	12	58
20-30	17	103*	19	98*
30-40	11	64	13	77
40	2	16	5	34
Total	50	284	50	272

*Modal coefficient interval

Source: Summarized from coefficients of variation derived for sample population.

Although the distribution of the coefficients of variation for the producers sampled in Alberta approximates a normal curve, more producers would be subject to deductions than to premiums. On the deduction side of Tables 6.1 and 6.2, it can be seen that 156 (1976) and 145 (1977) producers would be required to produce 50 percent of the total milk produced, while 127 (1976 and 1977) producers on the premium side produced the other 50 percent. It may then be inferred that the producers with higher coefficients of variation in industrial milk supply (those penalized) have smaller dairy operations, while producers with lower coefficients of variation have larger dairy operations. If this inference is true, a negative relationship between the size of dairy operations and producers' coefficients of variation would then exist.

If producers' coefficients of variation, signifying the degree

of market imbalance in industrial milk supply, tended to decrease as the size of dairy operations increased, the implementation of a seasonal pricing plan could have severe financial ramifications on new entrants. New entrants are likely to be less experienced in operating a dairy farm and may have smaller operations. If these individuals secure a high coefficient of variation in industrial milk supply, they would be penalized large deductions per hundredweight under a seasonal pricing plan. This would reduce the returns earned by new entrants. In Table 6.4 the number of producers at specific levels of shipments are outlined. Over the past three years the number of producers in Category 1 has declined. This decline may be accelerated under a seasonal pricing plan if a negative relationship was found to exist between the size of a dairy operation and the producers' coefficients of variation, as large financial penalties could force new entrants out of business.

Table 6.4--Number of Industrial Milk Producers According to the Level of Butterfat Shipped, Alberta, 1974-1977.

Category Number	Number of Butterfat	Number of Producers	Percent	Number of Producers	Percent	Number of Producers	Percent
		1974-1975		1975-1976		1976-1977	
1	Less than 5,499	603	45.5	513	37.4	299	37.6
2	5,500 to 10,499	417	31.5	482	35.2	471	43.4
3	More than 10,500	304	23.0	376	22.4	314	29.0
	Total	1,324	100.0	1,371	100.0	1,084	100.0

Source: Canadian Dairy Commission, "Number of Producers and Butterfat Shipped at Specific Levels of Shipments, 1974-1977" (Ottawa: February 7, 1978). (Mimeograph.)

To determine whether a relationship exists between the coefficients of variation of the sample producers and the size of their dairy operations, a correlation analysis was undertaken. Each producer's M.S.Q. was taken as the variable specifying the size of his dairy operation. Each producer's M.S.Q. and his respective coefficient of variation were tested to determine the degree to which the size of a dairy operation explains the resulting coefficient of variation. A correlation analysis was done for 1976 and 1977. The coefficient of determination[1] (r^2) was used as an indicator to explain the degree of correlation between the size of a sample producer's dairy operation (indicated by M.S.Q. size) and his contribution to milk supply imbalance (indicated by his derived coefficient of variation).

The correlations between M.S.Q. and the sample producers' coefficients of variation are shown in Table 6.5. A z test was used to test the statistical significance of each correlation. The results of the correlation analysis showed evidence of a significant inverse (negative) relationship between M.S.Q. and the coefficient of variation. Therefore it can be interpreted that the coefficient of variation tended to decrease as the size of the dairy operation increased. Although the coefficients of determination were significant, they indicated a weak relationship between the two variables. This indicates that there are other variables related to the coefficient of variation, for instance, weather, pasture conditions, and dairy policies.

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[1] $$r^2 = \frac{n(\Sigma xy) - (\Sigma x) \ (\Sigma y)}{[n \ (\Sigma x^2) - (\Sigma x)^2 \ ] \ [n(\Sigma y^2) - (\Sigma y)^2]}$$

Table 6.5--Correlations Between M.S.Q. and the Sample Producers' Coefficients of Variation, Alberta, 1976, 1977 and 1976 and 1977.

Year	Pearson's r	Coefficient of Determination	Significance
1976	-.1575	.025	.004
1977	-.1905	.036	.001
1976 and 1977	- .1710	.029	.001

Source: Results of Correlation Analysis Between M.S.Q. and Sample Producers' Coefficients of Variation.

A stronger relationship between the size of the sample producers' dairy operations and their coefficients of variation may have been observed if a variable other than M.S.Q. had been used to specify farm size. This is possible due to the Alberta Dairy Control Boards' policy of not charging penalties for over-quota shipments. Producers are then able to ship milk to their full capacity, which may exceed their allowable M.S.Q., without fear of financial repercussions.

Problems Anticipated with Russell's Seasonal Pricing Plan

In the seasonal pricing plan suggested by Russell, graded deductions from producers contributing to milk supply imbalance were used to award premium payments to those producers furnishing a more uniform supply of milk. Deductions and premiums were assigned according to the position of the producer's coefficient within the fifty steps of the premium and deduction schedule (Table 3.4, Chapter III). Producers with coefficients in the first twenty-five steps would receive premiums whereas producers in the last twenty-five steps would be required to

pay a penalty under a seasonal pricing plan for milk. In order that the deductions finance the premiums, the marginal increments in payment between each step were made equal.[1] Russell's premium and deduction schedule, illustrated in Table 3.4 of Chapter III, indicates that the marginal increment between each step was one cent.

It is difficult to determine whether an increment of one cent per step, proposed by Russell, would induce the producers in New England to reduce the fluctuations in their supply of milk. For instance, the cost to a producer of adjusting his coefficient of variation of 50.0 to between 43.1 and 48.5, may exceed the one cent benefit per hundredweight (Steps 49 and 50, Table 3.4, Chapter III). Consequently, before any seasonal pricing plan is introduced, it is imperative that data be collected concerning 1) the degree of adjustment required to move up one coefficient step (if, in fact, that small of an adjustment could be made), and 2) the marginal cost of production adjustments at each step, to ascertain what monetary increment per step would be effective. This is a difficult task as both the degree of adjustment and the cost of production adjustments will vary with the size of the dairy enterprise and the techniques employed. In Table 6.6, the monthly milk shipments of two Alberta producers are shown. Both have coefficients in step twenty-four of the deduction section (Table 6.1). The lower and upper limits of each producer's milk shipment as a percent of his expected shipment were similar. The lower and upper limits for Producer One were 34 and 163 percent of his expected monthly shipment, respectively.

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[1] As long as each step represents 2 percent of total milk production, this method of payment will allow the deductions to finance the premiums.

Similarly, Producer Two supplied 36 and 165 percent of his expected monthly shipment. However, Producer One had twice the M.S.Q. of Producer Two. Although both producers have the same degree of variation, differences in the size of the operation may cause the cost of adjustments per hundredweight to vary. Both operations may be conducive to implementing certain changes considered economically infeasible to the other.

Table 6.6--Monthly Shipments of Two Alberta Industrial Producers with the Same Degree of Variation but Varying in Size, 1976.

Producer	J	F	M	A	M	J	J	A	S	O	N	D	M.S.Q.	C.V.
1	88	80	200	300	384	358	303	313	244	172	116	98	9900	45.2407
2	47	37	70	93	139	153	167	127	104	84	63	58	4263	41.0084

Source: Data obtained from dairy processing plants' monthly statements. Coefficient of variation obtained from analysis of the sample producers' milk supply pattern.

It is doubtful that this type of premium and penalty schedule would work if costs of production were taken as the main criterion for establishing the rate of payment. The plan assumes constant marginal increments between each step. It is improbable that the costs of production would be constant as well. Therefore, a cut-off point would exist after which producers would not be encouraged to improve their supply pattern as the costs would exceed the benefits. Alternatively, a schedule could be developed where the coefficients were categorized into steps so that the rate of payments corresponded to some estimated costs of production. The problems with this alternative are two-fold. First, it is an enormous task to determine the techniques and adjustments

that producers at each coefficient step are likely to employ to reduce supply fluctuations. Secondly, it is probable that the deductions would no longer finance the premiums, thus requiring financial aid from either the processors or the government.

In his seasonal pricing plan for milk, Russell proposed two alternative methods for deriving producers' coefficients of variation. He suggested that if a uniform milk supply pattern is desired, producers' coefficients of variation should be based on expected shipments reflecting constant monthly supply. On the other hand, producers' coefficients could be based on a desired market sales pattern where producers' expected shipments reflect fluctuations in the market sales pattern for processed milk. Under this alternative, each producer's average monthly shipment could be multiplied by twelve seasonal index figures reflecting the level of monthly processed milk sales, thus determining what Russell calls an 'adjusted-market-sales' pattern. To determine each producer's contribution to milk market imbalance, his coefficient of variation would be calculated on the basis of his deviation in raw milk supply from his determined 'adjusted-market-sales' pattern.

This alternative, however, presents problems in application. The first problem deals with the twelve seasonal index figures to be chosen. Questions could be raised concerning the group of products and the region which the market sales pattern represents. For example, a market sales pattern representing the whole of Alberta and all industrial dairy products would be inappropriate. It is unlikely that the sales pattern of individual industrial processors would match that of the province. Both the types of products processed and the proportion vary

between plants. To avoid this problem, the 'adjusted-market-sales' pattern could be based on the sales pattern of the plant to which the producer delivers. However, this leads to other problems. For instance, it may be difficult for a producer to transfer his business to another processing plant without incurring penalties, as it is likely that the producer's 'adjusted-market-sales' pattern would not correspond with the market sales pattern of the prospective processor. This problem could perhaps be resolved if a transfer program was devised to allow a producer to transfer to another processing plant without penalty.

Other difficulties would likely be encountered if a market sales pattern approach was used in calculating producers' coefficients of variation. For example, the sales pattern could not be expected to remain static from year to year. Either the producer's 'adjusted-market-sales' pattern would have to be adjusted annually or the processor could employ a representative sales pattern. Annual adjustment of a producer's expected monthly shipments do not permit him an opportunity for long range planning. Nor does the nature of his business allow him to make instantaneous adjustments. On the other hand, a sales pattern representative of the processor's annual sales could be determined by computing a five year moving average of the plant's annual sales. Due to the complexity of these problems, it would seem that a seasonal pricing plan with a constant monthly production orientation would be preferable in light of its relative simplicity and stability.

In his article, Russell discusses methods of collecting and distributing the deductions and premiums. He suggested that either 1) producers' premiums and deductions in the second year of the plan be based on the degree of stability achieved in the first year, or 2) that

$0.25/cwt be deducted from each producer's milk cheques with a bonus payment being made at the year's end, based on the stability each producer had achieved during that year. Producers receiving premiums would likely prefer the first option as they would receive premiums on a year round basis. This could aid their cash flow situation or they might invest the money to collect interest.[1] Processors, however, might prefer the second option as this would provide them with short financing.[2] Similarly, producers who had managed to reduce market imbalance during the year might also prefer option two, as they would more quickly realize the benefits of their efforts either as increased premiums or as reduced deductions.

Assuming that a rate of payment could be derived that induces producers to reduce milk fluctuations, another critical problem could emerge. The structure of Russell's seasonal pricing plan demands that penalty payments be deducted from the revenue earned by 50 percent of the total milk produced, despite the coefficient of variation level achieved. As a consequence of this condition, premiums and deductions are based not only on the individual producer's performance but on the relative performance of all shippers under the plan. Should all producers make the move to reduce milk fluctuations, there would be a large number of producers who would continue to pay penalty charges regardless of improvements in their coefficients of variation. These

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[1] Alternatively, they may wish to invest it in the dairy operation.

[2] This assumes that the deductions would not be handled by a third party. If processors were to be made responsible for deductions and were to encourage uniform supply, interest earnings on bonus payments should be included.

same producers would then be increasingly required to 1) bear the cost of reducing milk fluctuations, and 2) finance the premiums received by producers who also contribute to seasonal milk fluctuations but to a lesser extent. If such a situation was to develop, the plan could be detrimental to small producers. The results of the correlation analysis indicated that smaller dairy operations have larger coefficients of variation, that is, their contribution to market supply imbalance is greater than that of larger dairy operations who tend to have lower coefficients of variation. Unless smaller producers are able to make a larger adjustment in their supply pattern relative to other producers, they may be unable to improve their financial position by reducing milk fluctuations. Consequently, these producers may abandon all attempts to reduce fluctuations in milk supply or be forced out of the industry.

The structure of the seasonal pricing plan set out by Russell demands that the premium and deduction schedule be divided into fifty coefficient of variation steps, each representing 2 percent of the total milk supply. As a result of this structure, another problem may be encountered. This problem concerns the narrowing of the range of coefficients and of each coefficient of variation step as milk fluctuations are reduced. As the upper limit of the coefficients of variation decreases, the range of each coefficient step must narrow if the coefficients are to be divided into fifty steps. The range of each step may become so narrow that the level of market imbalance between each step may be insignificant. This would be true particularly for those coefficient steps around the modal coefficient range. As seen in Table 6.3 (1977), the modal coefficient interval 20-30 encompassed nineteen steps in comparison to the coefficient interval 0-10 which encompassed

one step. Therefore, as seasonal fluctuations are reduced and the range of each step becomes narrower, the deductions or premiums assigned to producers with coefficients within the modal coefficient range may be superfluous. To overcome this problem, it may be desirable to reduce the number of steps involved in the premium and deduction schedule, thereby increasing the possible range of each step.

Despite the problems associated with the seasonal pricing plan, there are desirable aspects that deserve mention. A seasonal pricing plan monitors the fluctuations in milk supply more closely than a seasonal subsidy program. The seasonal pricing plan examines the supply of milk on a monthly basis and attempts to correct milk supply patterns on the basis of each producer's deviation from a desired expected monthly mean. In comparison, a seasonal subsidy program can only correct for the volume of milk produced between seasons and cannot necessarily correct fluctuations in supply within each season. Secondly, under a seasonal pricing plan, seasonal pricing is separated from other price changes in milk. Pricing incentives against seasonal production are not directly incorporated into the actual pricing of milk as in some areas of the United States, where milk prices are dependent on the volume of Class I Milk shipped and its utilization (i.e., Base Excess Plan and Take-off and Pay-Back approach). The seasonal subsidy program, like the seasonal pricing plan, also separates seasonal price adjustments from the direct determination of milk prices. This is an important aspect as it is imperative that producers are able to see how seasonal price adjustments affect their net revenue.

Based on the problems discussed, implementation of the seasonal pricing plan would depend on whether its associated problems could be

resolved. The first problem that would have to be resolved is to determine the rate of payments that would induce producers to reduce milk fluctuations. Upon resolution of this problem, a workable plan could then be devised if adjustments were made so that producers premiums and deductions were not gauged according to the relative performance of other producers, but only on the individual producer's performance. This could be accomplished if the range of each coefficient step and the corresponding deductions and premiums established at the onset of the plan remained unchanged during the duration of the plan. Under such an approach, improvements in an individual's sales pattern would be based on the coefficient of variation he achieved and he would receive the corresponding deductions or premiums. As milk fluctuations and correpondingly, producers' coefficient of variation decrease, the deductions could no longer finance the premiums. It is at this point that financial aid would be required. A sharing of the costs among the parties affected by seasonality, for instance, the C.D.C. and the processors may be one solution. Hoever, should the cost of financing the premiums exceed the costs incurred due to fluctuations, it may well be that a pattern of fluctuating milk supply is more efficient on a cost basis than uniform milk supply.

CHAPTER VII

SUMMARY, CONCLUSIONS AND NEED FOR FURTHER RESEARCH

Summary

The focus of the thesis is 1) to determine whether a seasonal subsidy program would be an effective policy tool to induce industrial milk producers to increase their level of winter milk sales, and 2) to evaluate the feasibility of implementing Russell's seasonal pricing plan for milk. This chapter summarizes the study and its results, reports the conclusions, and discusses the need for further research. A summary concerning seasonal subsidy rates and the seasonal milk pricing plan is presented separately for purposes of clarity.

Seasonal Subsidy Rates

Throughout the thesis, it was assumed that rational producers would not reduce fluctuations in milk supply unless there was economic justification for doing so. Based on this assumption, summer and winter subsidy rates were proposed that reflected the differential cost of producing summer and winter milk. These rates were based on a sample of Alberta industrial producers' 1977 winter and summer costs of production. To evaluate the effectiveness of seasonal subsidy rates, five scenarios, each representing a different sales pattern, were presented and the average producer returns derived under each compared. Producer returns were used as an indicator of the likelihood of adjustments to increased winter sales. Because the policies and conditions stipulated in applying seasonal subsidy payments can affect the effectiveness of a seasonal subsidy program, producer returns under the five scenarios were computed

for each policy approach to seasonal subsidy payments.

The results of the analysis indicated that the average seasonally variable cost of producing winter industrial milk exceeded the cost of summer milk by $2.88/cwt. Under the policy assumption that the C.D.C. budget allowance for subsidies would not be extended beyond the current level of $2.66/cwt for in-quota milk (M.S.Q.), a summer and winter subsidy rate of $4.10/cwt and $1.22/cwt was derived. Employing these subsidy rates, two methods of subsidy payments were derived, each dependent on the conditions imposed. Given the condition that subsidy payments would be restricted to 50 percent of producers' annual M.S.Q. each season, the seasonal subsidy rates proposed in Method 1 would appear to be ineffective. For producers with a low level of seasonality, returns decreased as the sales level between seasons equalized. Although the returns for producers with higher levels of seasonality were expected to increase as sales equalized, the incremental increases in returns were low.

The second method of subsidy payments studied, Method 2, was dependant on the condition that all summer sales be subsidized at a rate of $1.22/cwt, while the balance of M.S.Q. be subsidized during the winter at a rate of $4.10/cwt. A comparison of producer returns under their current sales pattern and under a sales pattern where summer and winter sales equalized indicated that producers would not likely opt for equal sales each season as there was no compensation for their effort or the costs involved in initiating the sales adjustments.

Based on these results, a third alternative, a winter subsidy program, was proposed in an attempt to provide producers with increased monetary incentives. Under the proposed winter subsidy program, the winter subsidy rate was increased to $5.32/cwt and summer subsidies

discontinued. Winter subsidy payments, however, were restricted to M.S.Q. remaining in winter. To avoid a reversal in seasonality, the maximum amount of M.S.Q. eligible for winter subsidy payments was restricted to 50 percent of a producer's annual M.S.Q. The projected increase in producer returns as a result of supplying equal volumes of summer and winter milk was estimated at $574.21, as opposed to - $607.75 and $29.87 projected under the first and second method of subsidy payments.

As an alternative to the first policy assumption, a second policy assumed that the C.D.C. budget allowance for subsidy payments could be extended beyond the current level of $2.66/cwt for in-quota milk. A program was suggested that allowed producers to maintain their current level of returns provided they achieved equal sales between seasons. The program involved the implementation of the seasonal subsidy program introduced in Method Two in conjunction with a lump sum payment. The purpose of the lump sum payment was to compensate producers for lost returns. Upon the implementation of this program, producer returns could increase by $944.47 if they were to equalize winter and summer milk sales. This program requires the C.D.C. to increase its budget allowance substantially.

The above analysis was based on the assumption that producers' M.S.Q. were issued in April, the beginning of the dairy year. In 1978, the Minister of Agriculture announced that the federal government was changing the start of the dairy year to August. Although the new dairy year did not alter the results indicated in Method One of subsidy payments, it was necessary to revise the conditions stipulated in the second method which proposed that all producer summer sales be subsidized

at the summer rate of $1.22/cwt and the balance of M.S.Q. be subsidized during the winter at the winter rate of $4.10/cwt. This was necessary as this method required that the level of summer sales be known before winter subsidies were paid. With the dairy year beginning in August, the total level of summer sales would be unknown. Consequently, the second method of subsidy payments was revised so that all winter sales would be subsidized and the balance of M.S.Q. subsidized during the summer at the summer rate. The analysis of this approach indicated that for producers with low and high levels of seasonality, returns were expected to increase by $70.89 and $272.68, respectively, under equal summer and winter sales.

Lastly, an approach was tested where only winter subsidy payments were made on all winter milk sales. Producer returns were projected to increase by $650.22 once equal summer and winter sales had been achieved. This approach is similar to the previously proposed winter subsidy program, with the exception that winter subsidy payments were not restricted to the balance of M.S.Q. remaining in winter.

Russell's Seasonal Pricing Plan for Milk

The second objective of the thesis was to evaluate the feasibility of implementing a seasonal pricing plan for industrial milk in Alberta. The seasonal pricing plan, proposed by Russell, was devised to reduce seasonal milk fluctuations by penalizing or rewarding each producer according to his contribution to milk market imbalance. A statistical measure, coefficient of variation, measured the variation between a producer's monthly milk shipments and expected monthly milk shipments, thus indicating the degree of the producer's contribution

to milk market imbalance. Data were collected concerning Alberta industrial producers' monthly milk shipments during 1976 and 1977. Based on this information, each producer's coefficient of variation for 1976 and 1977 was then calculated. A correlation analysis was then undertaken to determine whether a relationship existed between the size of a dairy operation and a producer's contribution to market imbalance. M.S.Q. was taken as the variable specifying the size of the dairy operation while each producer's coefficient of variation represented his contribution to market imbalance.

The results of the analysis indicated a significant inverse relationship between the size of the dairy operation and the producer's contribution to market imbalance. Thus, as the size of the dairy operation decreases, a producer's corresponding coefficient of variation can be expected to increase. These results suggest that the emphasis of the seasonal pricing plan would be applied to smaller dairy operations and possibly new entrants.

Other problems likely to be encountered upon implementing such a seasonal pricing plan were addressed. The rate of payments that would induce producers to reduce market imbalance was seen as the most critical problem affecting the effectiveness of the plan. In order that the plan be self-financing, the deduction and premium schedule was based on constant marginal monetary increments between each level of market imbalance. However, it is improbable that the cost of reducing market imbalance to the preceeding level is constant for each level. Consequently, a cut-off point may evolve, beyond which producers may not

be encouraged to reduce supply fluctuations as the costs would exceed the monetary benefits.

Under the assumption that a rate of payment could be derived that would induce producers to reduce milk fluctuations, another problem was identified that would affect the outcome of the plan. This problem centered around the fact that the premiums and deductions assigned to each producer are based on his performance relative to the performance of other producers. Improvements in an individual's supply pattern will not result in financial gain if the relative improvements made by the other producers are greater. This is a direct result of the structure of the plan which demands that penalty payments be deducted from the revenue earned by 50 percent of the total milk produced, despite the level of market imbalance achieved.

Conclusions

Based on the results of the study and the problems identified for both a seasonal subsidy program and a seasonal pricing plan for milk, the following conclusions can be drawn.

Seasonal Subsidy Rates

1. The introduction of a seasonal subsidy program requires the C.D.C. to make decisions concerning 1) whether or not to extend the budget allowance for subsidies beyond the current level, and 2) whether or not the level of producer returns should be maintained or allowed to decline.

2. Based on the projections of the sample producers' net returns under the various proposed subsidy programs, the following

was concluded.

a) A program incorporating both seasonal subsidy rates and a lump sum payment would be the most effective method for inducing producers to increase winter milk sales should the dairy year begin in April. A comparison of producer returns under their current sales pattern and under a pattern of equal summer and winter sales indicated that i) producers with a 54/46 percent level of seasonality could expect their returns to increase by $944.47 to an annual net returns level of $14,354 and ii) producers with a 65/35 percent level of seasonality could expect their returns to increase by $2,619.54 to an annual net returns level of $16,078. The feasibility of implementing a lump sum approach, however, is questionnable as it would discriminate against producers who supply relatively equal volumes of summer and winter milk.

b) A winter subsidy program, subsidizing all winter sales at a rate of $5.32/cwt, was determined to be the most effective method of subsidization, if the dairy year began in August. Producer returns were expected to increase by $650.22 if equal winter and summer sales were achieved. As with the program incorporating seasonal subsidy rates and a lump sum payment, the success of the program depends on whether discounted future returns exceed the cost of making production adjustments.

3. The subsidy methods likely to be most effective required the C.D.C. to increase its budget allowance so that the programs could be fully funded.

Seasonal Pricing Plan for Milk

1. The evaluation of the seasonal pricing plan for milk revealed two major problems that are likely to be encountered in

implementing a seasonal pricing plan. The problems concerned the rate of payments and the assignment of producer deductions or premiums relative to the market imbalance achieved by other producers. Resolution of these problems requires that:

a) The criteria concerning the plan's ability to be self-financing should be abandoned so that the rate of payments can be determined on the basis of the cost of adjusting to each preceeding level of market imbalance.

b) Individual producer's deductions or premiums should be gauged according to the performance of the individual and not relative to the performance of other producers. This can be accomplished if the range of each coefficient step and the corresponding deductions and premiums established at the onset of the plan remained unchanged during the duration of the plan. Therefore, premiums or deductions awarded to an individual would be based on the reduction in market imbalance relative to that of the other producers.

2. Under the changes suggested concerning the rate of payments and the assignment of deductions or premiums, additional funds would be required as market imbalance decreased. As market imbalance decreased, the deductions would no longer be able to finance the premiums. Financial aid could be provided by those parties affected by seasonality, for instance, the C.D.C. and the processors.

3. The results of the correlation analysis indicated a significant inverse relationship between the size of a producer's dairy operation and his contribution to market imbalance. These results suggest that smaller dairy operations contribute more heavily to milk market imbalance. It would then appear that the emphasis of a seasonal pricing plan for milk would be toward smaller dairy operations.

Need for Futher Research

Before any recommendations can be made regarding the type of plan or program to use to reduce seasonal milk fluctuations, further research is first necessary in the following areas:

1. The winter and summer costs, returns, and sales levels of industrial milk producers should be more extensively researched. In the study, the analysis of producers' costs of production was limited to a small sample of Alberta industrial producers. The weighted average of these producers' sales pattern indicated a 54-46 split in summer and winter sales. This low level of seasonality does not correspond with the high level of summer sales indicated in Figure 1.1. Although this may be the direct result of the size of the sample used in the study, the high level of summer milk sales noted in Figure 1.1 may also be the direct result of the seasonal supply of industrial milk by fluid shippers. It is unknown to what extent fluid shippers contribute to summer and winter sales of industrial milk. Given 1) that fluid shippers have a commitment on the volume of fluid milk they supply daily, and 2) that the costs of producing winter milk exceed the costs of producing summer milk, fluid producers may find it difficult to supply industrial milk to the industrial market in winter. On the other hand, they may be able to take advantage of spring flush and the lower cost of producing summer milk and supply a large volume of milk surplus to their daily commitments to the industrial market in summer. By doing so they are able to reap the benefits of producer subsidies paid on in-quota industrial milk, thereby increasing their returns.

Consequently, before any plan or program dealing with seasonality is introduced, the extent to which fluid shippers are responsible for

seasonality must be determined. The plan or program must be able to deal effectively with fluid shippers should the results of future research indicate that the bulk of industrial milk shipped by fluid producers is supplied during the summer period. The winter subsidy program suggested in the thesis would be ineffective in inducing fluid producers to reduce the supply of summer milk if the industrial price (not including the subsidy payment) exceeds the cost of producing summer milk. However, the introduction of a program similar to the Daily Entitlement Program introduced in Manitoba in conjunction with a seasonal subsidy program may be able to deal effectively with fluid producers. For instance, the average daily volume of industrial milk shipped by producers during the winter months could set the daily entitlement of summer milk eligible for industrial prices and summer subsidy payments. The plan could be further developed so that summer industrial milk shipped in excess of the producer's daily entitlement receives a lower industrial price and earns no subsidy payments. Such a plan would largely be directed at highly seasonal suppliers of industrial milk and could deal with fluid shippers to the same extent as industrial shippers. The savings from reduced summer subsidy payments and from reduced industrial milk prices could be reserved for redistribution during the winter.

2. Further to the derivation of industrial producers' current costs of production and the effect of fluid producers' shipments on industrial milk supply, the cost of 1) equalizing winter and summer milk sales and maintaining it, or 2) achieving a pattern of uniform milk sales and maintaining it should be ascertained. It may well be that the costs associated with 1) equalizing milk sales, or 2) achieving

a pattern of uniform sales and the cost of administering a program to reduce fluctuations in milk supply exceeds the cost incurred by the C.D.C., the processors and other involved parties. The costs incurred by the C.D.C. and the processors as a direct result of fluctuations in milk supply should therefore be ascertained to determine whether seasonal industrial milk production is more efficient on a cost basis. Should a seasonal supply of industrial milk prove least costly, the costs and benefits of a seasonal supply of milk may need to be redistributed among the parties in the industrial milk system so that all parties incur a share of the costs and benefits. Similarly, if there are cost savings under a uniform supply of milk, the costs and benefits of such a supply pattern may need to be redistributed among all parties involved.

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APPENDICES

APPENDIX A

QUARTERLY INDUSTRIAL MILK QUESTIONNAIRE

Name: ______________________ No. ____________ Month: ________

Year: 1977

ALL INDIVIDUAL ACCOUNTS WILL BE KEPT CONFIDENTIAL.

Use your own actual situation and experience to estimate proportions to dairy as indicated. The dairy enterprise means everything associated with milking and dry cows and dairy young stock. It is important that the information be provided each month.

Item	Office Use Only	
Milk Sold to plant at No. 1 Price	lbs ________	$ ________
Milk Sold to plant at No. 2 Price	lbs ________	$ ________
Butterfat Test		________

Hauling ________ A,D,C,B, ________ Producer's Fees ________ Market Fees ________

Question	Total Farm	Dairy Portion
1. Lbs. of milk sold other than to plant	________	________
2. Value of milk sold other than to plant	________	________
3. lbs. of milk fed to young stock (not colostrum)	________	________
4. Lbs. of milk used in home	________	________
5. No. of milking cows at the end of month	________	________
6. No. of dry cows at the end of month	________	________
7. Veterinary and medicine expenses this month	________	________
8. Breeding fees and A.I.	________	________
9. Livestock supplies	________	________
10. Building, hardware, fence - repairs	________	________
11. Dairy equipment repairs	________	________
12. Field equipment repairs (non-powered)	________	XXXXX
13. Power mach., truck and automotive repairs & licenses (Estimate dairy portion________%)	________	________
14. Fuel, oil, grease (Estimate dairy portion ________%)	________	________
15. Utilities (Estimate dairy portion ________%)	________	________
16. Taxes and insurance paid this month	________	________
17. Cash rent paid this month	________	________
18. Interest on capital loans paid this month (Estimate dairy portion ________%)	________	________
19. Interest on Operating Loans (Est. Dairy Portion ________%)	________	________
20. Charges for cleaning & treatment of seed	________	XXXXX
21. Fertilizer and chemicals	________	XXXXX
22. Custom charges and other services	________	________

23. Other expenses (DHIA, legal, accounting, etc.) ______ ______

b. (twine, shavings, etc.) ________________ ______ ______

24. Wages paid to hired labour this month (including fringe benefits and board) (Est. Board $ ______) ______ ______

25. Cash wages paid to family labour this month ______ ______

26. Total working hours spent this month: (Determine true no. of hours spent in dairy enterprise by all labour. This includes operations such as milking, feeding, bedding, breeding, veterinary, feed preparation, cattle sales, purchases, repairs, routine tractor hours in dairy, etc.)

a. Operator ____ hours per day x ____ days ______ ______

b. Partner (if any) ____ hours per day x ____ days ______ ______

c. Hired and paid family labour
1st____ hours per day x ____ days ______ ______
2nd____ hours per day x ____ days ______ ______
3rd____ hours per day x ____ days ______ ______

d. Unpaid family labour ____ hours per day x ____ days ______ ______

27. Total hours this month

28. Cattle situation during the month.

Dairy Herd	Beg. Mo. No.	Purchased No.	Purchased Value	Sold No.	Sold Value	Born No.	Born Office Use	Death(D) Homeuse(H) No.	Death(D) Homeuse(H) Value	Transferred To Beef Herd No.	Transferred To Beef Herd Value	End of Month No.	End of Month Office Use
Dairy Cows						XX	XXX						
Bred Heifers						XX	XXX						
Open Heifers						XX	XXX						
Heifer Calves under 12 mos.													
Bull Calves under 6 mos.													
Herd Bulls						XX	XXX						
Totals													
Other Livestock													

29. Miscellaneous receipts from: Custom work ______ ______
Farm business dividends ______ ______
Direct Government subsidies: a) Milk only ______ ______
b) Other ______ ______
Insurance receipts ______ ______
C.W.B. payments ______ XXXXX
Misc. income, specify:________________ ______ ______

30. No. of animal units (A.U.) on pasture - 1 A.U. = 1 cow = 1.5 heifer = 3 calves
No. of animal units on pasture this month ______ ______

31. Crop situation this month:

	Produced		Sold		Purchased		FEED FED - To DAIRY and OTHER L.S. Purchased			Home Grown		
	Quan.	Office Use	Quan.	Amt. Rec'd.	Quan.	Total Value	Quan. Dairy	Other*	Value	Quan. Dairy	Other*	Office Use
Barley bu.												
Oats bu.												
Wheat bu.												
Mixed Grain cwt												
Alfalfa Hay ton												
Mixed Hay tons												
Silage, wet tons												
Dairy Ration cwt	XXXX	XXXX								XXXX	XXXX	XXXX
Salt cwt	XXXX	XXXX								XXXX	XXXX	XXXX
Supplement cwt	XXXX	XXXX								XXXX	XXXX	XXXX
Calf Feed cwt	XXXX	XXXX										
________( )												
________( )												
________( )												
Straw tons												
Grinding $	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX		XXXX	XXXX	XXXX
Total	XXXX		XXXX		XXXX		XXXX	XXXX		XXXX	XXXX	

*Other Livestock

Seed used this month: | bu: | bu: | bu: |

Crop share disposal (this year crop) ____________ bu. $ ____________

____________ bu. $ ____________

Question	Total Farm	Dairy Portion
32. a. Home grown straw used for bedding (tons)	______	______
b. Purchased straw used for bedding (tons)	______	______
33. Dairy equipment: a. purchases (specify: ____________)	______	______
b. sales (specify: ____________)	______	______
34. Field equipment: (non-powered) a. purchases (specify: ____________)	______	XXXXX
b. sales (specify: ____________)	______	XXXXX
35. Tractor, truck, auto & powered machinery: a. purchases (specify: ____________)	______	______
b. sales (specify: ____________)	______	______
36. a. Total cost for new bldgs. (specify: ____________)	______	______
b. Buildings sold this month (specify: ____________)	______	______
37. Land sold ________ acres, purchased ________ acres	______	XXXXX
38. Milk quota sold ________ lbs., purchased ________ lbs.	______	______
39. Total debt on real estate, machinery and livestock (Fill in January and December only)	______	______
40. Short term debt position (Accounts Payable) (Fill in January and December only)	______	______

CAPITAL INVESTMENT QUESTIONNAIRE

Name: ______________________________ No. ______________ Year: ________

Home Quarter Legal Description:							
1. Land	* % D.	Total Acres	Pasture Only	Current Value	O F F I C E U S E		
Own							
Rented	---			---			
2. Dairy Buildings	% D.	Year	Initial Cost	O F F I C E U S E			
	100						
	100						
	100						
	100						
	100						
	100						
	100						
Total	100						

3. Crop Buildings:

Total	---						

4. Other Buildings:

Total							

Value of milk quota (Beginning year): $ lbs.

*Present Use for Dairy Enterprise

MACHINERY INVENTORY

Name: ____________

Year: ____________

1. Dairy Equipment:	% D.	Year	Initial Cost	OFFICE USE			
	100						
	100						
	100						
	100						
	100						
	100						
	100						
	100						
	100						
Total	100						

2. Field Equipment:

Total	---						

3. Power Machinery:

Total							

4. Other Equipment:

Total							

DAIRY CATTLE AND CROP INVENTORY

Name: ______________

Year: ______________

ITEM	Beginning Year (Jan. 1)		
	No	Office Use	Office Use
Cows			
Bred Heifers			
Ooen Heifers			
Heifer Calves (under 12 mo.)			
Bull Calves (under 6 mo.)			
Herd Bulls			
TOTAL			
	Value	Office Use	Office Use
Other Livestock			
Other Livestock			
TOTAL			
	Value	% to Dairy	Office Use
Fertilizer			
Gas, Oil, Grease			
Posts and Wire			
Twine and Shavings			
Dairy & Livs'k Supplies			
Supplement, etc.			
Other Supplies			
TOTAL			
Crops	Quant.	Office Use	Office Use
TOTAL			

Source: Alberta Agriculture, Production Economics Branch, 1977.

APPENDIX B

REGIONAL INPUT PRICES AND CAPITAL INVESTMENT CONVERSION FACTORS

Table 1. Regional Input Prices, Alberta, 1977.

Month	Hay Prices					Wheat Prices				Barley Prices				Oat Prices				Mixed Grain Prices				Straw Prices	
	Peace River	Edm.	Cal.	Red Deer	Leth.	Edm.	Cal.	Leth.	Peace River	Edm.	Cal.	Leth.	Peace River	Edm.	Cal.	Leth.	Peace River	Edm.	Cal.	Leth.	Peace River	Edm.	Cal.
Jan.	38	50	53	46	45	2.72		2.55	2.39	1.72	1.76	1.75	1.61	1.07	1.12	1.17	1.04	3.36	3.47	3.50	3.20	20	
Feb.	38	50	53	45	45	2.58	2.55		2.46	1.70	1.72	1.78	1.65	1.09		1.14	1.03	3.37	3.48		3.23	20	
Mar.	36	46	53	45	45	2.63	2.54	2.42	2.55	1.77	1.74	1.79	1.72	1.12	1.13	1.20	1.09	3.49	3.47	3.61	3.40	20	18
Apr.	36	47	53	45	45	2.59	2.51	2.51	2.48	1.73	1.77	1.86	1.68	1.12	1.15	1.27	1.09	3.44	3.53	3.80	3.35	20	18
May	36	48	54	45	45	2.71	2.59	2.58	2.51	1.80	1.82	1.93	1.71	1.16	1.20	1.32	1.11	3.56	3.66	3.95	3.41	20	18
June	36	48	54	45	45	2.68	2.64	2.56	2.44	1.80	1.84	1.99	1.74	1.16	1.20	1.34	1.08	3.58	3.63	4.04	3.39	20	18
July	36	48	55	47	50	2.60	2.76	2.43	2.40	1.73	1.77	1.92	1.61	1.13	1.15	1.29	1.05	3.46	3.53	3.89	3.21	20	18
Aug.	36	48	55	48	50	0	0	0	0	1.62	1.69	1.71	1.49	1.05	1.07	1.17	0.92	3.23	3.07	3.52	2.90	20	18
Sept.	36	48	55	48	50	0	0	0	0	1.53	1.48	1.60	1.50	1.00	0.97	1.11	0.94	3.06	2.96	3.29	2.94	20	18
Oct.	36	48	55	48	50	0	0	0	0	1.48	1.44	1.58	1.49	0.98	0.96	1.12	0.94	2.98	2.90	3.28	2.93	20	18
Nov.	36	48	55	48	50	0	0	0	0	1.41	1.41	1.58	1.47	0.95	0.94	1.11	0.93	2.86	2.84	3.26	2.89	20	18
Dec.	38	50	55	50	50	0	0	0	0	1.41	1.43	1.63	1.45	0.98	0.97	1.17	0.94	2.90	2.91	3.41	2.88	20	18

Prices: Cow:______ Bred Heifer:______ Open Heifer:______ Heifer Calf:______ Bull Calf:______ Herd Bulls:______

Value of Pasture: Tame:__________/AMU Value of Operator Labour: Edmonton:_____/hr; Calgary:_____/hr

Native:__________/AMU Value of Family Labour: Edmonton:_____/hr; Calgary:_____/hr Interest:_____

Adjusted Prices (Alfalfa Base): Green Feed Wet Silage Dry Silage Wet Green Chop Wet Haylage Dry Haylage

Dry Conversion: (Silage ; Haylage ; Brew ; Stillage) Green Chop

Source: Data provided by Alberta Agriculture, Production Economics Branch, Edmonton.

Table 2. Capital Investment Conversion Factors.

Basis: 4th Quarter 1976 = 1.00 on <u>buildings replacement</u> index

Buildings Year Purchased	Inflation Index	Depreciation	Conversion Factor to find Beg. 1977 Value	Depreciation Rate
1977	1.000	1.0000	1.0000	.05
1976	1.1330	.950	1.0764	"
1975	1.2793	.903	1.1552	"
1974	1.3930	.857	1.1938	"
1973	1.5576	.814	1.2679	"
1972	1.7732	.774	1.3725	"
1971	1.9196	.735	1.4109	"
1970	1.8814	.698	1.3132	"
1969	2.0812	.663	1.3798	"
1968	2.2085	.630	1.3914	"
1967	2.2802	.598	1.3636	"
1966	2.4210	.568	1.3751	"
1965	2.5028	.540	1.3515	"
1964	2.6174	.513	1.3427	"
1963	2.7267	.487	1.3279	"
1962	2.7430	.463	1.2700	"
1961	2.7000	.440	1.1880	"
1960	2.7540	.418	1.1512	"
1959	2.7680	.397	1.0989	"
1958	2.7819	.377	1.0488	"
1957	2.8251	.358	1.0114	"
1956	2.8574	.340	.9715	"
1955	2.8815	.323	.9307	"
1954	2.8634	.307	.8791	"
1953	2.9182	.291	.8492	"
1952	2.9686	.277	.8223	"
1951	3.4635	.263	.9109	"
1950	3.8689	.250	.9672	"
1949	4.1437	.237	.9821	"
1948	5.1466	.225	1.1580	"

Table 2 con't

Buildings Year Purchased	Inflation Index	Depreciation	Conversion Factor to find Beg. 1977 Value	Depreciation Rate
1947	5.5305	.214	1.1835	.05
1946	5.5194	.203	1.1204	"
1945	5.5983	.193	1.0805	"
1944	6.2915	.183	1.1513	"
1943	6.5943	.174	1.1474	"
1942	7.5778	.165	1.2503	"
1941	8.3632	.157	1.3130	"
1940	8.9645	.149	1.3357	"
1939	9.8321	.142	1.3962	"

Table 2 con't

Basis: 4th Quarter 1976 = 1.00 on Truck Index

Trucks Year Purchased	Inflation Index	Depreciation	Conversion Factor to find Beg. 1977 Value	Depreciation Rate
1977	1.0000	1.0	1.0000	.35
1976	1.0222	.650	.6644	.115
1975	1.0676	.575	.6139	"
1974	1.2551	.509	.6388	"
1973	1.3217	.450	.5948	"
1972	1.3693	.399	.5464	"
1971	1.4070	.353	.4967	"
1970	1.4975	.312	.4672	"
1969	1.5288	.276	.4219	"
1968	1.6028	.244	.3911	"
1967	1.6179	.216	.3495	"
1966	1.6443	.191	.3141	"
1965	1.6569	.169	.2800	"
1964	1.6869	.150	.2530	"
1963	1.6882	.133	.2245	"
1962	1.7070	.117	.1997	"
1961	1.7548	.104	.1825	"
1960	1.7962	.092	.1653	"
1959	1.9091	.081	.1546	"
1958	2.0635	.072	.1486	"
1957	2.1124	.063	.1331	"

Table 2 con't

Basis: 4th Quarter 1976 = 1.00 on Tractor Index

Tractors Year Purchased	Inflation Index	Depreciation	Conversion Factor to find Beg. 1977 Value	Depreciation Rate
1977	1.0000	1.00	1.0000	.20
1976	1.0678	.800	.8542	.08
1975	1.1953	.736	.8797	"
1974	1.4401	.677	.9749	"
1973	1.4919	.623	.9295	"
1972	1.5323	.573	.8780	"
1971	1.5625	.527	.8234	"
1970	1.6159	.485	.7837	"
1969	1.6705	.446	.7450	"
1968	1.7152	.411	.7049	"
1967	1.7901	.378	.6767	"
1966	1.8681	.348	.6501	"
1965	1.9326	.320	.6184	"
1964	2.0393	.294	.5996	"
1963	2.1113	.271	.5722	"
1962	2.2394	.249	.5576	"
1961	2.3014	.229	.5270	"
1960	2.3560	.211	.4971	"
1959	2.5202	.194	.4889	"
1958	2.7074	.178	.4819	"
1957	2.7722	.164	.4546	"

Table 2 con't

Basis: 4th Quarter 1976 = 1.00 on <u>Combine Index</u>

Combines Year Purchased	Inflation Index	Depreciation	Conversion Factor to find Beg. 1977 Value	Depreciation Rate
1977	1.0000	1.000	1.0000	.25
1976	1.0921	.750	.8191	.115
1975	1.2279	.664	.8153	"
1974	1.4693	.587	.8625	"
1973	1.5338	.520	.7976	"
1972	1.5824	.460	.7279	"
1971	1.5941	.407	.6488	"
1970	1.6368	.360	.5892	"
1969	1.6925	.318	.5382	"
1968	1.7410	.282	.4910	"
1967	1.7602	.249	.4383	"
1966	1.8747	.221	.4143	"
1965	1.9511	.195	.3805	"
1964	2.0070	.173	.3472	"
1963	2.0598	.153	.3151	"
1962	2.1685	.135	.2927	"
1961	2.2274	.120	.2673	"
1960	2.2802	.106	.2417	"
1959	2.4389	.094	.2293	"
1958	2.6212	.083	.2176	"
1957	2.6828	.073	.1958	"

Table 2 con't

Basis: 4th Quarter 1976 = 1.00 on Non-Power Index

Machine Year Purchased	Inflation Index	Depreciation	Conversion Factor to find Beg. 1977 Value	Depreciation Rate
1977	1.0000	1.000	1.0000	.35
1976	1.0487	.650	.6817	.115
1975	1.1639	.575	.6692	"
1974	1.3684	.509	.6965	"
1973	1.4259	.450	.6417	"
1972	1.4711	.399	.5870	"
1971	1.4861	.353	.5246	"
1970	1.5423	.312	.4812	"
1969	1.5805	.276	.4362	"
1968	1.6243	.244	.3963	"
1967	1.6747	.216	.3617	"
1966	1.7297	.191	.3304	"
1965	1.7721	.169	.2995	"
1964	1.8173	.150	.2726	"
1963	1.8611	.133	.2475	"
1962	1.9309	.117	.2259	"
1961	1.9856	.104	.2065	"
1960	2.0321	.092	.1870	"
1959	2.1731	.081	.1760	"
1958	2.3345	.072	.1681	"
1957	2.3906	.063	.1506	"

Table 2 con't

Basis: 4th Quarter 1976 = 1.00 on small tools index

Machine Year Purchased	Inflation Index	Depreciation	Conversion Factor to find Beg. 1977 Value	Depreciation Rate
1977	1.0000	1.000	1.0000	.45
1976	.8390	.550	.4615	.115
1975	.6790	.486	.3300	"
1974	.9985	.430	.4294	"
1973	1.4459	.381	.5509	"
1972	1.6066	.337	.5414	"
1971	1.6506	.300	.4952	"
1970	1.6835	.264	.4444	"
1969	1.7454	.233	.4067	"
1968	1.7384	.207	.3598	"
1967	1.7634	.187	.3298	"
1966	1.6696	.162	.2705	"
1965	1.5687	.143	.2243	"
1964	1.6246	.127	.2063	"
1963	1.8703	.112	.2095	"
1962	1.8643	.099	.1846	"
1961	1.9161	.088	.1686	"
1960	1.9612	.078	.1530	"
1959	2.0940	.069	.1445	"
1958	2.2537	.061	.1375	"
1957	2.4235	.054	.1309	"

Table 2 con't

MONTHLY DEPRECIATION RATES

Month Purch.	5%	8%	11.5%	20%	25%	35%	45%
12	.0042	.0067	.0096	.0167	.0208	.0292	.0375
11	.0083	.0133	.0192	.0333	.0417	.0583	.075
10	.0125	.02	.0287	.05	.0625	.0875	.1125
9	.0167	.0267	.0383	.0667	.0833	.1167	.15
8	.0208	.0333	.0479	.0833	.1042	.1458	.1875
7	.025	.04	.0575	.10	.1250	.1750	.225
6	.0292	.0467	.0671	.1167	.1458	.2042	.2625
5	.0333	.0533	.0767	.1333	.1667	.2333	.30
4	.0375	.06	.0362	.15	.1875	.2625	.3375
3	.0417	.0667	.0958	.1667	.2083	.2917	.375
2	.0458	.0733	.1054	.1833	.2292	.3208	.4125
1	.05	.08	.115	.20	.25	.35	.45

APPENDIX C

DAIRY QUESTIONNAIRE DATA SUMMARY

Table 1--Winter Industrial Milk Costs and Returns

		Total Enterprise	Per Cwt Produced
Receipts			
Milk sold to plant	2594.89 cwt	23081.76	8.41
Other milk sales	12.93 cwt	162.30	0.06
Milk used in home	17.39 cwt	164.98	0.06
Other receipts		6884.79	2.51
Cattle sales		1856.29	0.68
Livestock trans. to other enterprises		16.00	0.01
Less livestock trans. from other ent.			
Less cattle purchased		- 1520.00	-0.55
Inventory change (+-)		- 134.58	-0.05
Total Receipts		30501.56	11.11
Enterprise Costs			
Grain	55.06 tons	3466 85	1.26
Complete feed	17.42 tons	1954.33	0.71
Supplement	6.69 tons	1538.40	0.56
Salt, minerals, vitamins	12.40 cwt	106.71	0.04
Roughage	176.80 tons	8051.18	2.93
Pasture	18.10 amu	134.00	0.05
Processing costs		99.48	0.04
Total Feed Costs		15350.93	5.59
Hired labor	679.24 hours	1207.14	0.44
Bedding & supplies		1333.38	0.49
Vet., medicine & breeding		573.78	0.21
Cash overhead (taxes, util., etc.)		1579.95	0.58
Bldg. & mach. operating costs		1991.13	0.73
Marketing & transportation		4551.43	1.66
Miscellaneous		186.10	0.07
Total Other Costs		11422.91	4.16
Total Variable Costs		26773.84	9.75
Fixed Costs			
Operator & family labor	1753.23 hours	6545.94	2.38
Depreciation		1605.31	0.58
Interest paid		950.31	0.35
Interest on equity		3155.66	1.15
Total Fixed Costs		12257.23	4.46
Total Enterprise Cost		39031.06	14.21
Return Over Variable Costs		3727.73	1.36
Return To All Labor & Management		- 776.43	-0.28
Return To Management & Risk		- 8529.50	-3.11

Source: Computer Printout: Dairy Questionnaire Study results.

Table 2--Winter Labor and Production Report

	Dairy		Other	
	Hours	Value	Hours	Value
Operator labor	1135.03	4748.94	488.97	2054.86
Hired labor	152.24	324.34	33.46	60.38
Family paid labor	527.00	882.80	306.65	1066.20
Family unpaid labor	618.20	1797.00	180.10	553.74
Total	2432.47	7753.07	1009.18	3735.17
Milk Production	Lbs.	% of Total	$	Average Value
No. 1				
No. 2	259489.50	94.50	23081.78	8.90
Other milk sales	1293.00	0.47	162.30	12.55
Fed to calves	12078.40	4.40	1076.57	8.91
Fed to other livestock				
Used in home	1738.80	0.63	154.98	8.91
Total	274599.63	100.00	24475.63	8.91
Other	1378.13			
Hauling cost	1378.13			
A.D.C.B. fees	43.53			
Producer Assn. fees	37.34			
Market share fees	3092.44			
Number of cows milking	40.60			
Number of cows dry	14.70			
Lbs. butterfat produced	10336.82			
Number of Heifers born	13.00			
Number of Bulls born	15.30			

Source: Summary of dairy questionnaire study results.

Table 3--Winter Management Factors

A. Livestock		
Milk production per cow	4965.63	lbs.
Fluid milk sales per farm	2607.82	cwt
Butterfat test of milk (average)	3.76	%
Butterfat per cow	186.92	lbs.
Grain and supplement fed per cow	1.44	tons
Roughage per cow	3.18	tons
Gross returns per $100 feed fed	198.70	
B. Labour		
Man equivalents - dairy enterprise	1.95	
Operating revenue per man equivalent	15674.14	
Cost of dairy labor per man-hour	3.19	
Net returns/man-hour - to dairy mangmt. & all labor	-0.32	
Labor per pound of butterfat produced	0.24	hrs.
Labor per cwt milk production	0.89	hrs.
Hours per cow	43.99	
C. Capital		
Operating revenue per $1000 of dairy capital	324.79	
Capital turnover	3.08	yrs.
D. Size of Business		
Number of acres	287.50	
Dairy capital investment	93912 56	
Number of milk cows	55.30	
Number of milk cows as a % of total herd	57.49	%
Total farm investment	335348.31	

Source: Summary of dairy questionnaire study results.

Table 4--Summer Industrial Milk Costs and Returns.

		Total Enterprise	Per Cwt Produced
Receipts			
Milk sold to plant	3035.28 cwt	26651.89	8.38
Other milk sales	12.51 cwt	167.40	0.06
Milk used in home	18.69 cwt	163.57	0.05
Other receipts		8280.88	2.60
Cattle sales		2235.48	0.70
Livestock trans. to other enterprises		28.00	0.01
Less livestock trans. from other ent.			
Less cattle purchased		- 460.45	-0.14
Inventory change (+-)		- 134.58	-0.04
Total Receipts		36931.98	11.59
Enterprise Costs			
Grain	44.00 tons	2974.60	0.93
Complete feed	17.39 tons	2168.19	0.68
Supplement	5.78 tons	1337.27	0.42
Salt, minerals, vitamins	8.21 cwt	62.66	0.02
Roughage	101.02 tons	4477.01	1.41
Pasture	183.10 amu	1377.30	0.43
Processing costs		104.02	0.03
Total Feed Costs		12501.04	3.92
Hired labor	764.40 hours	1622.99	0.51
Bedding & supplies		537.07	0.17
Vet., medicine & breeding		471.40	0.15
Cash overhead (taxes, util., etc.)		1169.78	0.37
Bldg. & mach. operating costs		2490.60	0.78
Marketing & transportation		5296.45	1.88
Miscellaneous		222.18	0.07
Total Other Costs		11810.46	3.71
Total Variable Costs		24311.51	7.63
Fixed Costs			
Operator & family labor	1406.00 hours	5226.09	1.84
Depreciation		1605.31	0.50
Interest paid		767.64	0.24
Interest on equity		3155.66	0.99
Total Fixed Costs		10754.70	3.38
Total Enterprise Cost		35066.21	11.01
Return Over Variable Costs		12620.47	3.96
Return To All Labor & Management		8714.84	2.74
Return To Management & Risk		1865.77	0.59

Source: Computer Printout: Dairy Questionnaire Study results.

Table 5--Summer Labor and Production Report

	Dairy		Other	
	Hours	Value	Hours	Value
Operator labor	857.30	3591.03	927.70	3876.63
Hired labor	233.00	461.09	51.40	89.41
Family paid labor	531.40	1161.90	472.10	929.88
Family unpaid labor	548.70	1635.06	427.50	1282.50
Total	2170.40	6849.07	1878.70	6178.43
Milk Production	Lbs.	% of Total	$	Average Value
No. 1				
No. 2	303527.88	95.26	26651.89	8.78
Other milk sales	1251.00	0.39	167.40	13.38
Fed to calves	11977.40	3.76	1053.96	8.80
Fed to other livestock				
Used in home	1858.80	0.58	163.57	8.80
Total	318615.00	100.00	28036.81	8.80
Other				
Hauling cost	1540.30			
A.D.C.B. fees	54.15			
Producer Assn. fees	45.99			
Market share fees	3656.01			
Number of cows milking	43.35			
Number of cows dry	11.90			
Lbs. butterfat produced	11237.44			
Number of Heifers born	10.30			
Number of Bulls born	13.00			

Source: Summary of dairy questionnaire study results.

Table 6--Summer Management Factors

A. Livestock		
Milk production per cow	5766.79	lbs.
Fluid milk sales per farm	3047.79	cwt
Butterfat test of milk (average)	3.53	%
Butterfat per cow	203.39	lbs.
Grain and supplement fed per cow	1.22	tons
Roughage per cow	1.83	tons
Gross returns per $100 feed fed	295.43	
B. Labour		
Man equivalents - dairy enterprise	1.74	
Operating revenue per man equivalent	21270.26	
Cost of dairy labor per man-hour	3.16	
Net returns/man-hour - to dairy mangmt. & all labor	4.02	
Labor per pound of butterfat produced	0.19	hrs.
Labor per cwt milk production	0.68	hrs.
Hours per cow	39.28	
C. Capital		
Operating revenue per $1000 of dairy capital	393.26	
Capital turnover	2.54	yrs.
D. Size of Business		
Number of acres	287.50	
Dairy capital investment	93912.56	
Number of milk cows	55.25	
Number of milk cows as a % of total herd	57.49	%
Total farm investment	335348.31	

Source: Summary of dairy questionnaire study results.